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Ironfoundry Production in 1945

The Ministry of Supply have just released to the C.F.A. the statistics of production of iron castings for 1945, and in their consideration the date must be kept well in mind. Last year (which included both VE- and VJ-days) saw the beginnings of the reconversion to civilian production, but it is clearly shown that the Service departments were virtually the sole customers of the industry. Yet some trends are significant when viewed in the light of the fact that the changeover was not under way until the autumn. There was a serious decline in the overall production of iron castings, amounting to 178,600 tons, of which ingot moulds, at an output, were 40,000 tons lower, and machine tool castings were down by 30,000 tons. The largest increase is shown by the textile section, where the production rose from 18,700 to 44,400 tons—only about 5,600 tons short of the 1940 output—the earliest figure available. There was a pleasing increase in exports, carried out under conditions of an acute shortage of shipping space, of 54,700 tons. At 93,200 tons the previous year's total was more than doubled. There was a remarkably speedy recovery in the bath and cistern sections, as during this transition period they managed to double the production, and since then steady progress has been made. A comfortable reserve should be in hand by the time the housing programme gets into its stride, despite the gloomy stories of the daily Press.

An outstanding fault with these M.O.S. statistics is the lumping together of malleable cast-iron fittings with cast-iron pipes. Under normal conditions, fluctuations in the production of the latter would mask any changes in the highed-priced and quite different malleable castings. Again, malleable castings may figure under several other headings. No doubt this served the purpose of the Ministry, but it is useless for tracing the operating conditions of an important section of the ironfounding industry. A matter difficult to reconcile is the comparatively slight decrease in the production of rolls compared with the serious drop in ingot mould output. It is probably accounted for by the fact that industries other than that of steel manufacture take large quantities of cast-iron rolls. The decline in the output of munitions is clearly shown, and further reductions will be evident when the figures for 1946 are published. It was not pleasing to see for the first time for many years an overall production of just under the two million ton mark. Of technical significance is the use of steel scrap. During the war there was a distinct increase—several per cent. in its consumption in cupola charges—but by 1945 it was virtually reduced to the 1940 level of 6 per cent. as related to the total output of castings. The use of refined and cylinder irons seems to have increased, but there is some difficulty in assessing the true situation, as since 1943 there has been a reorganisation in the presentation of this particular figure. To be of real service to the industry, the time lag between the collection of data and their publication must be shortened, and to this end it is obvious that the co-operation of all foundry managements must be won. For their own ultimate benefit, we ask our readers to supply the authorities with the requisite figures with a minimum of delay. A good guess promptly made is more helpful than punctillious precision, which causes undue delays.

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CORRESPONDENCE

[We accept no responsibility for the statements made or the opinions expressed by our correspondents.]

ANALYTICAL DISCREPANCIES

To the Editor of the FOUNDRY TRADE JOURNAL.

SIR,—My friend, Mr. R. D. Lawrie, is reported to have said: "*A bulk supply of fine turnings (cast iron) was divided up and sent to 10 laboratories, and when the results were received no two were exactly similar.*" Of course not. The same would have applied had the 10 samples been 10 motor-cars, ships, sets of twins, anything. Ten grey-iron castings made in 10 different foundries, or all in Mr. Lawrie's foundry, will not be exactly similar in weight, dimensions, perfections, defects, not to speak of other physical properties or of performance under service conditions. Further, Mr. Lawrie states that when the ten results were found to be all different, "*the average of the three nearest was taken as representing the analysis of that particular sample.*" This is backing the minority with a vengeance. The three laboratories in agreement may be so because they happened to employ the same method, just as testing machines of the same design may give results very similar to one another but different from those obtained from machines of other and possibly better design.

What are known to-day as British Chemical Standards were under investigation 25 years ago when we used to meet in Middlesbrough to discuss results from co-operating laboratories at home and abroad. It is possible that it is beyond human power to make or to do two things so similar that no test can detect a difference, and I suggest to Mr. Lawrie that one cannot take a bulk supply of fine turnings of a graphitic cast iron and divide them into 10 lots each exactly similar. Like many extremely difficult problems it looks simple. What is very astonishing is that foundry chemists permit someone not a foundry chemist to get away with a bubble damaging to them if not pricked—and so very easily pricked. Having had many years' experience of the inaccuracies of the laboratory bench, and, equally, of those of the foundry floor, and having seen ironfoundry practice grow in accuracy not a little because the laboratory took a hand, it seems to me that the idea of "science hand-in-hand with labour" does not mean that science should hold with *both* hands for fear of getting one beneath the belt.

Anyway, to close this letter, when an analyst's results all agree then is the time to suspect their accuracy, and when a foundryman's castings are all alike then is the time to apply for one's harp ration.

Yours, etc.,

HORACE J. YOUNG.

15, Lansdowne House,
Manchester, 20.
May 31, 1946.

CHARLES CHURCHILL & COMPANY, LIMITED, machinery and tool merchants, etc., of Kennington, London, S.E.11, have taken official possession of four redundant shops at the Scotswood Works, Newcastle-upon-Tyne, of Vickers-Armstrongs, Limited. A subsidiary concern, Churchill-Redman, Limited, will operate the works and make machine tools for the parent firm.

PUBLICATION RECEIVED

The Kingston Research Laboratory. Published by Aluminium Laboratories, Limited, and available from its associated company—Aluminium Union, Limited, Grosvenor House, Park Lane, W.1.

There is a real pre-war flavour about this brochure. It is a Canadian production, and is beautifully bound in heavy green cloth, carrying a bold panel on which is embossed the title in aluminum-coated letters. For the inside of the covers a metallic ink has been used to give the appearance of anodising. The buildings and equipment illustrated are representative of the latest practice in industrial research, and separation into divisions follows standard procedure. Much care has been given to the layout and equipment of the foundry section for the provision of raw material for the rest of the departments. The reviewer has but one small criticism to make, and that is the printing of two micros contiguously, one in black and the other in a bluish-green. The latter looks more like the bottom of a drained horse-pond than a respectable photo-micrograph. For the rest, the reviewer has nothing but unqualified praise. The value of this laboratory to the home industry is that it works in close liaison with the equally well-equipped establishment at Banbury.

MEEHANITE RESEARCH INSTITUTE

About 50 members participated in a two-day convention held last week at the North British Hotel, Edinburgh. Some twenty technical Papers were presented, one of which showed by means of the use of the ultra-rapid camera just how sand packs itself on ramming. At the annual dinner, presided over by Mr. John Cameron, J.P., a number of interesting speeches were made by Mr. R. B. Templeton, Mr. N. E. Rambush, Mr. Knorsih, a member from Belgium, Mr. E. M. Currie, managing director, and Mr. John Cameron, junr. Mr. V. C. Faulkner, who was the guest of honour, also spoke.

NOTES FROM THE BRANCHES

LONDON.—At the invitation of the directors of Ealing Park Foundry, Limited, a second works visit by members will take place on June 27. Admission is by ticket only. Tickets have already been sent to the unsuccessful applicants for last February's visit, but there are still a few vacancies at the time of going to press. Applications for these by postcard to Mr. F. Arnold Wilson, c/o William Jacks & Company, Limited, Winchester House, Old Broad Street, London, E.C.2, will be dealt with in strict rotation until the list is completed.

BRITISH NON-FERROUS METALS FEDERATION

At the first annual general meeting, held in Birmingham on June 6, Mr. Horace W. Clarke was re-elected president. Mr. W. J. Terry, Mr. W. H. Henman and Mr. H. E. Jackson are vice-presidents, and Mr. R. Lloyd Gibbins the honorary treasurer. The secretaries are Peat, Marwick & Mitchell. It was announced that Mr. N. B. Ker Lindsay had been appointed director and Mr. Paul E. Grainger, statistician. New premises had been acquired at 132, Hagley Road, Edgbaston, Birmingham.

MASS PRODUCTION OF TANK WHEELS IN "BLACK HEART" MALLEABLE

Discussion by East Midlands and Lancashire branches

The following discussion took place after this Paper by Mr. A. J. Bill and Mr. J. Peers had been read before the East Midlands branch of the Institute of British Foundrymen, in September, 1945. *The Paper appeared in the* JOURNAL *of May* 23 *and* 30.

DISCUSSION

MR. SMITH said the Paper emphasised that no matter how one mechanised, one always had to bring in the human element; therefore it was unwise to over-mechanise.

MR. BILL, in reply, said there was trouble with metal handling in the early stages, but greater emphasis had been placed on the pouring of moulds rather than on the quality of metal.

MR. PEERS said it should be realised that at the time the plant was working, Lincoln was much nearer the war than Derby, and there was a sense of great urgency. That probably prevented the introduction of many improvements in mechanical devices.

MR. SANDERS asked if the 50 per cent. of rejects mentioned caused by misruns were not in part due to the use of two strainer cores in each runner? Also, as far as off-set castings were concerned, might these not be due to wear on the box lugs?

MR. PEERS, in reply, said that it was found that the use of two strainer cores in each runner were necessary to prevent slag inclusions. One core was in a horizontal position on the joint line at the base of the down gate, and one in a vertical position further along the channelled runner. Although the double check did have an extra chilling effect on the first metal down, it could not be regarded as detrimental. When misruns occurred, it was usually found that the metal had frozen at the first check, partly, or wholly blocking up the holes in the core. Once a flow of metal through the first check was established, there was little risk of a misrun casting. Regarding offset castings, wear on holes drilled in box-part lugs was not appreciable, since each box-part was used only two or three times each day, approximately 100 pairs of moulding boxes being in circulation for each pair of machines. Assembling pins and pattern pins were subject to a much greater amount of wear, and these were replaced at $\frac{18}{1000}$ in. on assembling pins and $\frac{15}{1000}$ in. on pattern pins.

Labour Utilisation Per Ton of Castings

MR. ROXBURGH remarked that he assisted with the layout of the plant, and also with the operation of it, and said he would like to place on record his appreciation of the very great efforts the Authors expended in the actual running of the plant. A further point he wished to emphasise was that in the production of these castings it was necessary to put down a mechanised plant as soon as possible, so in the main they did not wish to depart from the practice to which they had become accustomed. Should they decide at some future date to go in for continuous melting, however, naturally the problem of distribution of the metal and of casting would be quite a different one. In any future schemes the question of improvement and development would be given serious thought. The question of whether to use the roll-over type of machine or the squeeze machine was a matter of opinion, particularly when one was using a box with quite a number of bars in the box-part. In that case one had to take certain measures to secure a success. In the future, in considering mechanisation, the shortage of man-power had to be borne in mind. The plant in question, both from the manufacturing and process side, was run with approximately 1.3 employees per ton of finished good castings. A figure of 1.2 was quoted for some of the latest foundries in America, so it was felt that although the plant could be improved, the experience gained in this connection would be of very great benefit in the future. There was one question that might be of interest. Great importance had been stressed on sand control, and as the plant in question was only in operation approximately 18 months, he (the speaker) wondered if it had run on for a longer period whether they would have experienced trouble with silt in the sand.

MR. PEERS said the only real question that Mr. Roxburgh had raised was that of silt. No doubt it would have arisen, but one thing that had not been mentioned was the installation of plant for extracting dust. A plant for this purpose was installed, and of course that solved the silt problem, at the same time it eliminated fines, etc.

Sand Moisture Content

MR. PEACE said he was interested in the drop in moisture content of the sand; this was very great, being from approximately 7 per cent. to approximately 6 per cent. Perhaps information could be given regarding the time the sand was on route from the mill. He would also like to know what was the capacity of the hopper; if it could be expressed in terms of a number of moulds, so much the better. A more open sand than is normally used in malleable foundries was employed and the Authors' opinion as to its effect on the skin of these castings. In connection with pattern plate pins and the clearance allowed for expansion of boxes, the speaker said he would like to know if any trouble had arisen. He had never heard before so much stress given to the need for attention to moulding machines and pattern plates.

MR. BILL, replying, said with regard to the sand in use that mention was made in the Paper that a change was made to a Pickering sand —a yellow sand with a high clay content. The mixture was 87½ parts of used

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sand, 5 parts Pickering sand and 7½ parts of coal dust. The finish on castings was at all times particularly good; part of that probably was due to the fact the patterns were always kept clean, the finish of the casting itself, in the speaker's opinion, being largely influenced by the cleanliness of the pattern. Regarding moisture content of the sand, tests were normally taken at the mill, and it was not until trouble was experienced with dry sand that the loss of moisture was discovered. That was due to the temperature of the sand in the system, which had been as high as 30 deg. C., which was a fairly high temperature. The capacity of the hopper for 25 moulds was 35 cwt. Moulds were produced in very rapid and variable times, and trouble with moisture content certainly was an important factor, and an extra 1 per cent. addition at the mill was always allowed in order to obtain approximately 6 per cent. for moulding.

Advantages of Continuous Pouring

MR. BRAIDWOOD said the Authors had been commendably frank; they had encountered many difficulties and it was obvious that these had not been wholly overcome; the Authors had operated under a heavy handicap. The plant had been equipped with an air furnace of 20 tons capacity which, with the help of another furnace in an adjoining shop, supplied metal in three separate and busy periods of about an hour each, during which pouring was carried out by the moulders and by hand methods. Had these furnaces been serving some form of active receiver, say an electric furnace, the Authors would have had a supply of superheated metal at their disposal throughout the entire day, and pouring could have been virtually continuous using mono-rail conveyors and geared ladles. By such means the moulders would have been moulding uninterruptedly, fatigue throughout the plant would have been greatly reduced and the output from the machines would have been very considerably increased. Furthermore, mis-run castings, which were stated by the Authors to be the predominant cause of such waste as then encountered, would have been less evident. Moreover, much less floor space and roller conveyor track would have been required within the plant. It might be claimed that the direct-arc electric furnace would be prone to give carbon pick-up on the low-carbon iron used, but systematic addition of steel scrap with balancing additions of ferro-silicon would counter that tendency.

The speaker, concluding, said he could see nothing impracticable about his suggestion and he was strongly of opinion that the installation, initially, of two or more smaller air furnaces—say of 10 tons capacity each—supplying molten iron to an electric furnace of suitable type and capacity, would have been a metallurgical enterprise which would have reaped rich reward.

The Time Factor

MR. BILL said the question of continuous melting was considered before the plant was laid out and it was turned down for two reasons. The first one was because it would have increased the amount of plant, and the maximum production of castings had to be produced within a limited time. Therefore a plant which was obtainable in the shortest space of time was installed. There was, however, the metallurgical aspect. Continuous pouring was used in the United States for the production of Blackheart malleable, but they had very great difficulty in producing a low total carbon such as was needed for the quality of metal produced. There were two main methods of continuous production of Blackheart material—one was a combination of cupola and electric furnace and the other was a combination of cupola and reverberatory furnace. Electric furnace metal was high in carbon content as there was normally no reduction of carbon, which was approximately 2.7 per cent. from the cupola. There was an attempt to reduce the carbon by putting cold steel in the melt, but the resulting metal was nowhere near 2.3 per cent. carbon. Similarly, when using air furnaces cupola metal refinement was limited, finishing at approximately 2.5 per cent., that being about the lower carbon metal regularly produced in the United States by duplexing.

A MEMBER said one thing that struck him particularly in the foundry described was that the lay-out indicated a completely mechanised plant; but was it over-mechanised? The monorail was not used, casting and knocking out of moulds was done by hand, all very arduous work. To his mind the foundry was not correctly designed, and he would like Mr. Bill to state what improvements he considered could be made in the lay-out.

MR. BILL replied that he had yet to see any foundry in which there was not a large proportion of hard work. He could suggest improvements that could be made to the plant described, and had in fact pointed out that it was one of the very few of its kind working in white cast iron and malleable iron.

Regarding operation, metal handling could have been made much easier by using a monorail, but unfortunately hand pouring was essential. With regard to knocking out, that was never regarded as satisfactory; but the castings had to be treated very carefully.

Moulding Methods Reviewed

MR. BUTTERS said the plant struck him as being typically American in design, and everything appeared satisfactory until one came to the moulding section, and there he must confess to disappointment. He thought they had reached a point where they could make moulds with the elimination of flat ramming. Considering the size of box used, approximately 24-inch square, he was surprised to see machines of the roll-over type on this plant, when jolt ram moulding machines with squeezer heads could be used to eliminate this arduous operation. Also, they were using very heavy cast-iron moulding boxes when they could get steel moulding boxes to make castings of 58 lbs. and of a weight that could be handled with much less fatigue by manual labour. Regarding the bumping of moulds against each other on the roller conveyor, caus-

ing off-set castings, there was moulding equipment so designed that when the box closed, the stub pin locked the top and bottom about the last $\frac{3}{16}$-inch of its registering. That certainly would eliminate any cross joint. The speaker said he felt convinced that his suggestions would materially increase the speed of production with much less manual effort involved, which, after all, was mechanical aid properly applied.

MR. BILL said in reply that the machines used would perhaps have been better if they had included a squeeze, although he would have preferred a Slinger in combination with a roll-over. Ramming a mould for a low-carbon casting was a very different proposition from ramming a mould for a grey-iron casting. Ramming difficulties due to the danger of hot tears, the higher temperature of the metal, and the much greater speed at which the mould was poured, were contributory features calling for careful ramming. With regard to moulding boxes, the all-important factor of supply had some bearing on this; cast-iron boxes were immediately available, whereas steel boxes were in short supply. Incidentally a steel box would necessitate the use of bottom boards on plates which were undesirable. Output was governed entirely by ability to cast and turn round moulds, it was not fatigue on the part of machine operators.

MR. HALLAMORE, at the conclusion of the discussion, proposed a hearty vote of thanks to the Authors for a most interesting Paper.

MR. GOODWIN seconded the vote of thanks.

MR. BILL, on behalf of the Authors, briefly replied.

The following is an abstract of the discussion which followed the presentation of the Paper before the Lancashire branch, and which produced much additional and interesting information.

Vote of Thanks

MR. E. LONGDEN (Manchester), in proposing a vote of thanks to the Authors, said it was astonishing how much detail could be associated with a single casting. Most of the Papers which were read to the branches dealt with systems and principles, but in this instance they had had a minute account of the production of one single casting. A modern way of handling metal, particularly one with such a short freezing range as malleable iron, ought to be adopted. One did not need to point continuously to the American systems which had been so much copied in this country during the past few years.

He had looked forward to hearing a little more concerning the actual class of metal going into the bogie wheels described, and he supposed that it was because steel was in such short supply during the war that it was necessary to turn over to malleable iron. He did not quite understand about the use of blackheart, unless it was that the annealing process was shorter and possibly economical. It might be suggested that whiteheart malleable iron would have been a more serviceable material because of its greater stiffness and strength. Perhaps there was no need to think about wearability because there was not a wearing surface, but he did think that quicker results could have been obtained by melting in the cupola for whiteheart production.

He was somewhat amused by the reference to the moisture content of the sand by which the moisture content was based at the mill. The suggestion might be made that it would have been better taken at the mould, though, after all, he did not suppose the moisture content would be much more than 4½ per cent. to 5 per cent. at the time of pouring. This remark was made because he had been to a foundry in the Midlands where they were making bogie wheels in a crude way. The sand controls were very bad and they wondered why they had scabbing. The moisture content was close upon 8 per cent., and therefore it was not surprising that the castings were defective.

Turning to the pouring of the castings, and the spilling at the spout, would it not have been possible to arrange a tipping spout so as to have continuous pouring? Was it really necessary to pour in two places? Was it because of some construction problem, and in order to get a more uniform system of distribution throughout the mould, because with the monorail system the casting could be much simpler and more effective? The casting was a fairly large one as far as malleable iron was concerned, and it was a pity that one particular plant which had been devised would have to close down.

MR. A. E. DAVIES (Newton-le-Willows) seconded the vote of thanks. As a matter of fact, he had attended the meeting in order to listen to something about mechanisation. There was great disparity between the foundry with which he was concerned and the one which had been described in the Paper. For instance, in his own particular foundry they would make about 4,000 moulds and they would be lucky if they got 4 tons of iron; so that it could be imagined that his problem with regard to mechanisation was somewhat involved.

MR. J. W. GARDOM (President of the Institute), in supporting the vote of thanks, said the plant dealt with had been explained very well, and perhaps he had understood it better than anyone else in the room because the firm with which he was associated had a very similar plant. When they were given the job of making similar wheels to those which had been described, the first thing they did was to go to Ley's where they were already making them. They were shown the method adopted, and then, of course, they thought they could improve upon it; but after the plant was installed it did not seem to be an improvement upon the one at Ley's. One thing which impressed itself upon his attention was the method of melting and pouring. He had used cupola and rotary furnaces, but they did not yield the best type of blackheart. They did not consider that the very best blackheart was required for a bogie wheel so they did not try to get it.

He did not quite understand why Mr. Bill should say he could not lift the box on to the machine because it was a heavy job, yet at the same time knocking out was done by hand. This was a little

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puzzling to him, particularly when it was stated that the top box and the bottom box were of similar weight. Frankly, he felt the Authors of the Paper had rather failed to deal with what he would term the fine points with regard to mechanisation, and which his firm preferred to describe as mechanically-aided production because physical labour was very largely eliminated.

He saw the method of straightening the wheels at Lincoln. Personally, he thought it was a rather crude method and even wrong, because the wheels were not being heated evenly. Mr. Bill had described how they were placed in the conveyor, and so on. What he had done at his foundry was to make the wheels roll through the furnace, and they came out at the bottom equally heated. The wheel itself, being round, came out round. That was true mechanisation. He had thoroughly enjoyed the reading of the Paper. It had recalled to his mind a great many worries and troubles which he knew Mr. Bill and Mr. Peers must have experienced as he had himself.

A Successful Culmination

After the vote of thanks had been carried, MR. BILL, in responding, disclaimed any responsibility for the design of the particular plant which had been described. He had been presented with a plant and had been told to make as many bogie wheels out of it as he could. Startlingly enough, despite the fact that the plant was not fully mechanised as mechanisation was generally understood, it at all times met the production schedules, and, moreover, it proved to be also a sound economic proposition.

After all, bogie wheels had been produced to a specification which had built up the reputation of his firm to a position of pre-eminence in Europe for producing a material which compared more than favourably with that of their American competitors. They did produce high-grade blackheart malleable iron, and had been doing it for many years to those most exacting customers, the automobile manufacturers.

Tipping Spout

Needless to say, there were many points he could have discussed with Mr. Gardom, and received benefit from his guidance from the point of view of mechanism, speed of handling and ease of handling, and with this remark he would couple Mr. Longden's suggestion of a tipping spout for the handling of the iron. The question of a tipping spout for their particular iron had been discussed. The composition was 2.3 to 2.45 per cent. carbon, 0.9 to 1 per cent. silicon and 0.3 to 0.4 per cent. manganese.

He would like someone to tell him how to handle that particular material by any other method than by hand ladles, as quickly from the furnace to the mould without freezing. Mis-run accounted for three-quarters of the total scrap over the whole period. Despite the fact that the wheels were extensively machined by several different machinists who used various methods of location, and although the machining allowance was only $\frac{3}{32}$ in., rejects from machinists were virtually non-existent.

He would assure his hearers, and perhaps Mr. Davies would support him in making the statement, that the only way to use white iron was to get it from whatever furnace it happened to be available and turn as quickly as possible into the mould. That was the keynote of the whole business. The training of the ladle-men was something which was handed down from father to son, and they could have produced twice as many moulds per day had they had sufficient ladle-men available. They had to "make" ladle-men by all sorts of means, such as the granting of bonuses, etc. He did not know whether this reply would answer the question concerning the tipping spout, but the matter of metal distribution had proved to be a considerable headache.

Maintaining Fuidity in Malleable

MR. DAVIES referred to the fluidity in metals. He was concerned with whiteheart malleable castings which were very small and not more than $\frac{1}{16}$ in. His experience was that the more malleable iron was agitated, and the more it was poured from one ladle to another, the more difficult would be the running. His problem had always been with very light castings to get the metal from the cupola quickly. To pour it from one ladle to another when dealing with small castings would be fatal. He could not understand why Mr. Bill poured from a 5-cwt. ladle into the hand shank; he would have thought that the original suggestion of an overhead runway with a 5-cwt. ladle would be better. In the early stages when they transmitted the metal from one hot pot to another, it seemed as though agitation caused oxidation and that the fluidity went down, apart from the fact that it was probably being put into a cooler receptacle.

MR. BILL said he appreciated the query about the overhead runway, and pointed out that he had endeavoured to get the system into operation. The snag with this system, however, was the difficulty of getting the overhead ladle under, and away from, the stream of metal at the spout. Botting up and retapping was obviously impracticable, and he referred to his previous remarks on a tipping spout as an alternative. A two-wheeled bogie was more easily manœuvred than the suspended ladle, and, frankly, the available labour was so thoroughly scared of the metal that it was not felt to be wise to alter the original practice. He pointed out, further, that with the layout of the plant as it was, hand ladling of metal into the mould was necessary.

Core Practice

MR. HAROLD HAYNES (Ashton-under-Lyne) referred to a statement that the mould had been damaged by putting in the core. Had the Lecturers thought it necessary to put in the core? Was it necessary to have a dry sand core, or could the pattern be made to form its own core?

MR. PEERS said that with regard to any suggestion that they might have had a complete green sand mould, actually the core had a belly which obviously would not mould. They could have moulded a portion of the core in each half, but they would still have had the problem of the belly. It was considered better to make a simple mould and have the core put in afterwards. They had had no real trouble with coring, and there was very little scrap due to faulty core location. All things considered, he thought the method adopted was best.

MR. HAYNES said it was not shown in the design that it was a chamber core. It was a straight core.

MR. PEERS agreed that the sketch did not show the whole core, but the sketch was done by a draughtsman, and apparently did not include all that it might have done. The point was that there was a belly which made it impossible to mould the complete whole.

Practices Compared

MR. J. HILL (Bury), from his own experiences, had a great deal of sympathy for the Authors, and in his remarks did not wish to enter into any technicalities upon the layout of the plant, although, as Mr. Gardom had said, this would make a very interesting subject for a discussion. He did, however, wish to make a few comments upon the actual working of the plant as the Authors had found it and its workings, and as his firm had found it. Actually he had had very little serious trouble from cold metal, because of the method they had used for producing the metal. A duplexing process had been used, incorporating the cupola and rotary furnaces, and it was possible to obtain temperatures in the rotary furnaces much higher than that necessary to efficiently pour the castings. Consequently they could handle metal from the rotary furnaces, and get it over to the moulds, pouring by hand ladle, without any great difficulty being experienced regarding temperature. Initially, it was a question as to whether it was desired to use an air furnace or to duplex. Personally he considered there was a certain advantage to be gained in using an air furnace, if the air furnace was there in the first instance, as he could quite appreciate that to get the plant producing the required quantity of bogie wheels in a given time it was better to use the materials available and get on with the job, rather than go outside existing practice and start on something quite different.

Differences in Core Making

He did not regard the core as being of paramount importance, but he wished to mention the experience of the foundry with which he was associated. They used a silica sand, mixed with oil and dextrin. They obtained the green strength from the dextrin and used a very small percentage of oil sufficient to give the necessary dry strength, with a resultant low hot strength. There was a very good disintegration of the core. They had tried out some green sand cores. Girls were used for making the cores and placing them in the moulds. A synthetic sand was used, and some of its properties were not exactly as those of a natural sand. They used a clay with a low dry strength. As far as he was aware there was no difficulty occasioned through hot tears, but they did experience trouble from the cores setting hard. The labourers did not treat the castings as though they were made of a fragile material, and all the castings had a crack down the middle due to excessive rapping when knocking out the core. The method of inspection was very similar to that described by the Authors, and he assumed it was standard for the inspection of both white and annealed castings. He would like to endorse the Authors' views respecting the plasticity of the sand. He had had some considerable experience of a plasticity test developed originally by Mr. Sheehan, and he personally would rather have such a test as a routine control than all the other tests put together. The plasticity test, provided there was a sufficient general control of the sand, did denote that the sand had not got excessive moisture or excessive bond. Generally speaking, if it had been established together with other tests as to what were the working limits of the sand, then the plasticity test was sufficient to indicate whether the sand was being suitably controlled although it was of course necessary to take periodical checks of other properties.

Mould Sand and Coal Dust

Such trouble was experienced by adding too much fine coal dust, which reduced the plasticity. Adding too much coal dust also tended to make the sand ball up. They had experienced also a similar trouble with regard to wear on the plate, and four pieces of saw blade were welded to the pattern plate. In doing this they ran the risk of having a crushed mould. They did not, however, consider there was likely to be much trouble from crushed moulds as everything was supported, and they ran the risk of using a sand joint rather than have a gap at the joint. There was a hole, diameter of 1 in., inside the core, a measurement which he thought they obtained from the Authors' firm and found to be useful.

Dealing with the sketch shown, the method of putting the groove round the bottom in order to eliminate the sand was very good, though the foundry with which he was associated did not do it. Girls cored up the moulds, and some trouble was experienced through sand getting underneath the core and tipping it over. If the method described by the Authors had solved the problem, then it might have solved theirs also. The mechanical layout of the plant, and its technical details. was subject-matter for considerable discussion. It was sufficient to state that the Authors were asked to produce a given quantity of castings in a given time and that they produced them. There was really no need for any comment in this respect, because the plants were intended to be developed only for war purposes.

Exigencies of War

MR. BILL thanked Mr. Hill most sincerely for his kindly constructive and relevant contribution to the discussion, and said he found it most surprising that Mr. Hill's troubles had run so parallel with his own. So much had been said on the question of metal melting and distribution that he welcomed the opportunity of discussing the pros and cons with Mr. Hill who had had experience of an alternative method to the air furnace.

Mass Production of Tank Wheels

First he was pleased to find that Mr. Hill appreciated the air furnace had some advantages over duplexing. The plan for continuous melting was considered before the plant was laid down and was rejected for two reasons, chiefly. One was because it would have increased the amount of plant that was necessary. At the time of starting it was very difficult indeed to get any sort of plant whatever, and the maximum production of castings had to be obtained within a limited time. Therefore a plant was designed which incorporated as many of the standard articles of equipment which the parent firm had in hand. Continuous pouring was used in the U.S.A. for the production of blackheart, but they experienced difficulty in producing a low total carbon such as was needed for the quality of metal produced.

The two main methods of production in America were a combination of cupola and electric furnace, and a combination of the cupola and the rotary furnace. Electric furnace metal was high in carbon content since there was, normally, no reduction of carbon. It ran about 2.7 from the cupola, and an attempt had been made to reduce the carbon by putting steel into the melt, but carbon was not reduced to 2.3 per cent. which was the average achieved by the Authors. Similarly, when using the air furnaces the Americans were not able to get a very great degree of refinement of the cupola metal and they finished at approximately 2.5 per cent., and, generally speaking, that was the lowest carbon produced in U.S.A. from duplexing. He had made it clear previously that they had been producing metal for many years, and they had been determined to produce wheels to a similar high standard.

Disadvantages of Oil-sand Cores

He was afraid he could not recall chronologically all the points raised by Mr. Hill, but he was interested to hear he used a silica-sand core. In their own experience, with very rapid cooling range and high initial freezing point, they simply could not use a sea sand core. They did try, of course. Incidentally, there were two defects. One, perhaps, because they had not gone into the matter with sufficient thoroughness, and they dried their cores on end. Driers were not advisable if it was at all possible to dispense with them because they were expensive and a nuisance. With a sea sand core, with a relatively low green strength, they had troubles due to sagging, and he was certain that Mr. Hill would appreciate the limits of machining which were allowable. The amount of sag they got in their cores through the use of an oil bonded mixture was sufficient to produce a quantity of wasters. Furthermore, there was spreading at the base which meant the casting had to be trimmed at the base.

Use of an ordinary "black sand" core mixture, *i.e.*, spent moulding sand with red sand and resin additions resulted in a core with extra high green strength, but also, unfortunately, extra high dry strength, giving little or no disintegration. Needless to say, a considerable number of "wasters" due to cracking were experienced since these cores were so difficult to remove. It was then decided to use ordinary facing sand as a base sand with sufficient oil bonded silica sand to give easy disintegration. With the development and use of this mixture, core troubles largely disappeared. Further, it was an economical mixture, gave high green strength, low dry strength and obviated the use of expensive driers.

He was pleased to learn there was corroboration of the trouble experienced by using excessively fine coal dust, but they could not explain it and merely accepted it. Even Mr. Hill had not told them how it happened. Balling up was a really serious trouble. They encountered it largely because they had a 5-cwt. capacity mill which was overloaded. The milling time allowed was not sufficient to enable him to mill all the sand properly. It was largely red sand coated with coal dust which gave a definite line of cleavage and resulted in broken moulds.

Moulding Box Practice

With regard to the wear on moulding boxes, an ordinary cast-iron box was used instead of a steel box because they had been making bogie wheels in small quantities for something like 10 years, and they had developed the box for these particular castings. When the new plant was started up they used the same box. In order to prevent flashing, he used, as had been stated in the Paper, a hard iron electrode to weld up the box corners, but appreciated that no doubt Mr. Hill's saw blade was equally effective.

In reply to MR. A. SUTCLIFFE (Bolton), MR. BILL said they did not claim any novelty for the use of the groove at the bottom of the core print; they simply used it. They were dealing with women whose hands were not as strong as those of men. The runners were not facing the arms. Had they done so it would have been likely there would have been local hot spots and shrinkages. For Mr. Hill's information, the wheel was, of course, double run, with two feeders on the outside rims, and one on the centre boss. With regard to the weight of sprue to castings, the castings weighed approximately 56 lb. and the amount of sprue was 26 to 27 lb., which was relatively low.

Coal Dust Problems

MR. E. LONGDEN referred to the introduction of 5 per cent. of coal dust into the mould. What percentage of coal dust was there in the sand?

MR. BILL said they used a constant 5 per cent. addition of coal dust at the mill; what the actual percentage of the system sand was, he was afraid he could not say: obviously it would be higher than this. Neither had he any figures available as to the superfine coal dust mentioned in the Paper, he merely stated the fact that its introduction had coincided with trouble due to broken moulds.

MR. S. R. MILNER (Crewe) had had experience of adding fine coal dust and coarse coal dust to moulding sand. Mr. Bill had suggested the peameability figure was 35 to 40. Was not this rather on the low side, and with fine coal dust the figure would be likely to go lower still. The figure he used was about 40, and the foundry did not like to go below it, using a very fine pulverised material, about 85 per cent. through a 200 mesh sieve.

MR. BILL said they used 85 per cent. up to 90 per cent. through a 200-mesh sieve.

MR. MILNER said they used a coal dust which gave a green permeability figure of about 50. If the Lecturers got below 40, he would suggest it might be the cause of lack of permeability throughout the sand.

MR. BILL wished to make it clear that at no time was any real trouble experienced due to scrap from sand defects. He had, however, been perturbed in the early stages, as permeability figures started to drop—from 60 down as low as 30 to 25. However, no scabs or blisters occurred, and he wondered whether the general uniformity of the mixture, as distinct from its actual physical characteristics kept them from trouble due to sand defects?

MR. D. FLEMING (Manchester) thought it was generally accepted throughout the trade that as the coal dust went up so did the shortness of the sand go up. With more coal dust there was a much greater area distributed throughout the sand. The point really lay with the wettability of the coal dust; the greater the surface area the more trouble with a given percentage of coal dust. Therefore, he was inclined to ask what was the percentage of coal dust in the sand. It was stated that 5 per cent. was added, but it was stated also that 5 per cent. was added to new sand. It was finishing up with 50 per cent coal dust after the lapse of time; if it was not for loss during the casting process or the extraction of the coal dust.

Silt Extraction in Coal Dust Removal

MR. PEERS said a piece of plant was installed which was designed to extract the dust. It was built round the rotary screen, the object being to clear the air somewhat. It also did another useful job because it helped to clear out some of the silt which was accumulating, and no doubt it took up a lot of coal dust. A single sand was used, so that the newer sand had the coal dust in addition. Theoretically, he agreed, there must be a large amount of coal dust which was not burnt, but the castings which came out never showed more than a blue tinge on the skin. Obviously, if coal dust additions were excessive, they would be concerned about it, because it would cause more misruns. He thought the dust extraction plant did pull off a certain amount of unburnt coal dust. Returned sand was agitated in the rotary screen and it was known that a considerable amount of dust and fines went through the exhaust. The actual coal dust content was round about 7½ per cent. The extra fine coal dust used appeared to affect the plasticity and not any other property of the sand.

MR. FLEMING said that a similar result would be obtained by adding fine coal dust as would be the case by adding normal coal dust from the point of view of shortness. He suggested that from the point of view of shortness the coal dust had wettability and that would interfere with the plastic property.

Practice of Contemporary Plant

MR. HILL said that Mr. Bill seemed to require answers from him on certain points. First of all he would deal with the coal-dust pellets which were found in the sand. It was a synthetic sand and not a naturally-bonded moulding sand, and the reason for the balling up was perhaps quite different from that in a natural sand. When the pellets were examined carefully it was found that they were mainly composed of coal dust and bond. If more than 8 per cent. coal dust was added to the sand the coal dust appeared to coagulate and attract the bond to it. Permeability in any sand was important, but provided the grading of the sand grains was controlled, and the other general properties, then he did not think that permeability was quite as important as some people thought. In his opinion, it would appear to be an over-elaborated point. The box parts they used were made of steel.

Lastly, he was not of the opinion that an air furnace was better than duplexing. The point he had tried to make was that if there was a standard practice of producing a satisfactory metal with an air furnace, then if times were such that the plant required to be producing a quickly as possible, it was better to carry on with the standard practice. The floor area of the foundry with which he was associated was such that they could not carry a quantity of moulds. The total number of moulds they had to produce was approximately 550 per day of nine hours from four moulding machines, and they did this with approximately 150 moulding boxes.

They did have trouble initially when using the rotary furnace, and might not have experienced as much trouble using an air furnace, but most of the workpeople were unfamiliar with foundry conditions. In the duplexing process they operated, it was possible, if so desired, to get carbon below 2 per cent. by a heavy steel addition to the rotary furnace. If they had been able to spare the time solely on the metallurgical operation of the duplexing process, then he was quite convinced they could have produced consistently a malleable iron quite equal to any other being produced. It was possible to control the analysis to fine limits and they aimed at a carbon content of 2.4 per cent. What they did require was a process by which unskilled labour could very soon acquire skill in producing a metal to pass the specification. They had proved that it was possible to obtain results from the duplex process which were comparable with the malleable iron produced from an air furnace, if sufficient time was devoted to perfecting the process and a rigid control established.

After Mr. Bill had thanked Mr. Hill for his elucidation, the proceedings were concluded.

"PLATT'S BULLETIN," the house organ of Platt Bros. & Company, Limited, textile-machinery makers, of Oldham, points out that the difficulty of converting the various plants for the efficient production of modern textile machinery in quantities adequate to meet the world's great needs now show signs of being overcome, although the scarcity of skilled workers in some key processes, such as plate moulding, still persists. Foundry mechanisation is one of the methods being adopted to overcome the difficulty of labour shortages. There is every reason to believe that post-war production targets will be surpassed in the next 12 months.

E

BOOK REVIEWS

Economic Demography of Eastern and Southern Europe. By Wilbert E. Moore. Published by the League of Nations, and obtainable from Allen & Unwin, Limited, 40, Museum Street, London, W.C.1. Price (paper bound), 10s. 6d.; cloth bound, 12s. 6d. net.

This book is of major importance to planners, as it deals with the future of Europe in general, but with special reference to the eastern and southern countries.

Neglecting emigration, there are diagrams which show how, by 1970, the populations of most of the Western European countries will serious decline, whilst those of Eastern Europe will enormously increase. Mathematically it is often misleading to extrapolate curves, and the reviewer counsels the introduction of a little scepticism in accepting holus bolus the conclusions drawn. Already, the population statistics for this country as prognosticated have gone all hay-wire, for there is now an appalling dearth of facilities for maternity. Thus the reviewer wonders whether the main conclusion, that there are 44 million too many people engaged in agriculture in the predominantly agragrian States of Europe, is to be taken as gospel. It is pleasing to note that the United Kingdom shows up very well as an efficient, if small, agricultural country—only Denmark is superior as revealed by the statistical surveys. The book is really interesting for those who like to ponder on the future of Europe in relation to the world economic situation.

V. C. F.

Industrialisation and Foreign Trade. Published by the League of Nations, and obtainable from Allen & Unwin, Limited, 40, Museum Street, London, W.C.1. Price 7s. 6d. net (cloth bound 8s. 6d.).

It is cheering news to learn from this erudite survey that the industrialisation of undeveloped areas normally tends to favour rather than to hamper the trade of existing industrial countries. Yet the saying that "work makes work" has been current in the north of England for many decades. The subject matter of the book is quickly illustrated by a graph showing the growth since 1870 of the industrial production of the various countries of the world. It takes the position up to 1938. The United Kingdom percentage has during that period decreased from 31.8 to 9.2 per cent., whilst the U.S.A. has grown from 23 to 32.2 per cent., and Russia from 3.7 to 18.5 per cent., but only 4.3 per cent. in the 1926-29 period. The second diagram very clearly shows the effect of mechanisation during the 1936-38 period, where the production per individual shows throughout the world a striking increase, whilst the third shows that world trade based on a gold standard was at a maximum before the 1929-30 slump, and since that time has never recovered.

The next diagram which interested the reviewer is No. 6. This shows how greatly the United States lead in output per head—the U.K. being second in the world. In the 1926-29 period, which the diagram covers, the United Kingdom exports per head are well ahead of all others, as are the imports per head, and so it must be with a country in which only 7 per cent. of the population is engaged in agriculture. There are included as an appendix numerous tables, which are of unquestionable value to the student of economics.

The book is not exactly thrilling, but it carries more clues for the solution of the problem of world economics than a dozen detective stories for the elucidation of the crimes. As a work of reference it is extremely valuable.

V. C. F.

Exports.—A monograph prepared by the Export Committee of the British Engineers' Association, 32, Victoria Street, London, S.W.1. Price 2s., post free.

United Kingdom exports of engineering products are probably in the hands of fewer people than is generally imagined. It is not to this class that the booklet will make an appeal, but rather to those who from time to time receive an export enquiry through a merchant firm, but in the main have been contented to cater for the home market. Part I is an erudite summary of the current economic position of the United Kingdom in relation to the rest of the world. Part II is practical; it opens with examples of a few of the pitfalls of which the beginner must beware. A whole book could be devoted to this particular aspect. One which comes to mind, if the reviewer's memory serves him correctly—white is the colour of mourning in China. Another is that penknives with one definite trade mark are almost currency amongst some native tribes in South Africa. The items listed on page 29, which form the skeleton of selling prices, are a salutory reminder of the necessity to include a number of special expenses when doing export business.

Excellent advice is given under the caption "Overseas Representation." Amongst the most difficult things in business is the appointment of a foreign agent or representative, and the snags are well enumerated in a letter from Sir William McCallum, chairman of the British Chamber of Commerce in the Argentine. To the reviewer's mind No. 4 is the most significant, because it is obvious that agents will concentrate on lines which are the easiest to handle and neglect those presenting difficulties. An excellent analysis is made of export sales methods on page 35 *et seq*, and this is followed by really practical notes on packing, quotations, and foreign exchange. This section concludes with advertising and sales literature and a review of Government and other services available to the exporter. Finally, there is a short statistical summary. As a really practical handbook on exporting, this is easily the best the reviewer has so far encountered.

V. C. F.

THE DIRECTORS OF Ransomes & Rapier, Limited, engineers and ironfounders, etc., of Ipswich, propose to issue 212,000 ordinary shares as soon as agreement is reached with the Capital Issues Committee on the question of issue price.

A PRACTICAL APPLICATION OF THE QUALITY CONTROL CHART*

By F. L. HARRISON

In the metallurgical control of the production of cast iron comprehensive records are kept of all factors affecting the raw materials, the melting process and operations and the results obtained. Such records, although of vital importance, do not necessarily give a sufficiently clear indication of variations and their causes without a large amount of sorting out of the required details. Normal methods of graphing such related items as analysis *versus* mechanical properties are one means of collecting such details. It has been found that no definite clear-cut relationship can be readily established between practice and results. If, however, the various items are considered not singly but in groups, each group being of a fixed number of samples (from 4 to 10), taking notice not only of the averages of the groups but of the variations existing within each group, then a more satisfactory picture is obtained. In other words the comparisons are drawn not from single results but upon a statistical basis. The averages and the variations for each group are plotted as single points on a "quality control chart," such as is shown in Fig. 1. It is not proposed to enter into any theoretical discussion of quality control but to show how such a method is being applied to a commercial operation.

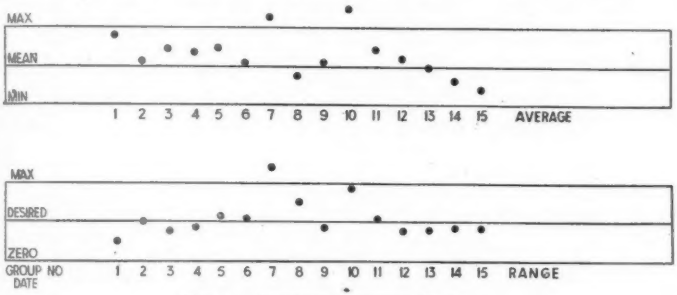

FIG. 1.—QUALITY CONTROL CHART.

Constructing the Charts

For each variable that is to be plotted, the average and the range (that is the difference between the highest and lowest result) within each group of samples is entered up on the chart. It will be seen from the sample chart (Fig. 1) shown that for average and range there are three lines drawn. The centre line represents the desired target, the upper and lower lines being the maximum and minimum figures. Points outside of the maximum and minimum figures represent a breakdown of control and demand immediate action. As the minimum line of the range is usually zero, it is the points falling above the maximum range that must be watched.

Potential Variables

It must be remembered always that any graphical method is influenced not only by variations in the items being measured but by variations in the measurements themselves. This means that the range of measurement must be standardised and maintained by periodic re-checking. The best method of doing this is by taking a fixed number of samples (preferably equal to the number of samples in one or two groups) and subjecting them to the particular method of measuring, *e.g.*, the determination of total carbon, silicon and tensile strength. The next step is to determine the limits of the chart which can be done either from results obtained whilst process is carried out with required supervision and control, or on the basis of past experience and the variation permissible whilst meeting all the requirements of specifications. The "quality control chart" is the indicator of satisfactory operation or otherwise of all the stages entering into control. These stages are:—(1) Checking, stocking, and issuing of raw materials — pig-iron, steel, scrap, coke, and limestone; (2) mixing, charge calculation, weighing and charging; (3) blast control, tapping and tending; and (4) testing of final product—rapid control tests, analyses, mechanical testing and castings inspection.

For each group plotted an indication is made if any change has occurred in any item associated with the process. A subsidary chart is used which contains a list of all such items and is numbered to correspond with the control chart groups. The alteration is indicated by a mark at the appropriate point, the precise details of the alteration being obtained from the records when required. Thus it is possible to get an immediate indication of changes in practice and whether or not corresponding changes occur in results.

Interpretation of Charts

Referring again to the specimen chart one may obtain from the points plotted a very clear indication of the value of such a chart. The first five points show satisfactory operation as evidenced by the range. As a result, for example, of a lowering of the silicon content of the pig it would be necessary to make additions of silicon briquettes to the charge. The next five points show what is considered to be breakdown of control, *i.e.*, points fall outside the lines. Corrective action must be taken to restore consistency of operation and also to check unduly high silicons. It will be noticed in the last five points that there is a steady downward trend in the silicon average. As the range

(*Continued on page* 168.)

* A prize-winning entry in a short Paper competition, organised by the East Midlands branch of the Institute of British Foundrymen.

GRAPHITISING ELEMENTS IN MALLEABLE CAST IRON

Dr. Harry A. Schwartz, in a Paper which he presented to the recent annual meeting of the American Foundrymen's Association on the subject of the "Chemical Composition of Malleable Iron," has included some notes of graphitising which are of outstanding interest, and which are reprinted below:

The following elements appear to affect the graphitising by their presence, while not themselves forming separate phases. They are given in the order of their atomic diameters, when known. These diameters are shown and also the group in the periodic table where the elements are found. The group number is also the number of valence electrons.

Elements Hindering Graphitisation

Element	*Atomic Diameter*	*Group*
H	?	I
O	?	VI
Cr	2.49	VI a
Mn	2.58	VI a
Mo	2.72	VI a
Elements Favouring Graphitisation		
B	——	III
P	——	V
Be	2.24	II
Si	2.35	IV
Ni	2.49	VIII a
Co	2.51	VIII a
Cu	2.55	I b
Al	2.86	III
Au	2.88	I b
Ti	2.90	IV a
Bi	3.10	V b
Zr	3.18	IV a
U (more than W = 2.75)		VIa

For comparison, carbon is in group IV with an atom diameter of 1.42 and iron in group VIII a, with a diameter of 2.48. Probably we do not know enough about the participation of the elements hydrogen and oxygen to engage in much discussion. Except hydrogen, all the retarders are in group VI, which also contains sulphur, and in sub-group "b," the elements selenium and tellurium. All the metallic retarders have atom diameters larger than iron. They all have diameters near enough to that of iron to permit formation of solid solution (within 12 per cent. or 15 per cent. according to Hume-Rotheray[1]), and these solutions are known. Two of them are known to be present in greater concentration in the carbides at low concentrations than in the ferrite. All the metals in group I which can alloy with iron are accelerators. Beryllium is the only metal of group II which has been kept allowed with iron. Boron and aluminium are the only elements in group III, about which much is known, though Ga in III b is nearly neutral.

All the elements of group IV which have been alloyed with iron are accelerators except that tin (Sn) has its effects obscured by sulphur.

Phosphorus and bismuth in group V may be compared with vanadium, whose carbides are inert and neutral. Tantalum in sub-group "a," and with neutral arsenic and antimony whose effect is obscured by sulphur in sub-group "b." Vanadium is alone as a retarder in group V. Tungsten in group IV a is inert, molybdenum and chromium are active retarders, and the early elements in group VI and those in group VI b are compound forming.

In group VII manganese is the only alloyable element and is a retarder. Group VIII a does not occur in iron and group VIII b contains iron and the accelerators cobalt and nickel, also the noble metals whose effects are weak and not thoroughly explored.

Most of the accelerators have larger atoms than iron but a few have smaller atoms. Within group VI a, however, the retarding effect first diminishes to zero, and the accelerating effect than makes its appearance as the atomic weight increases. It is very likely that the uranium atom is larger than tungsten in this group.

It seems fair to assume that four valence electrons are favourable to an atomic structure which will alloy and favour graphitisation. As the number falls first to three and then to two and one, the ability to alloy decreases, but where preserved the elements remain graphitisers.

Atomic Weight or Size

Five valence electron elements are not always accelerators but may be neutral or compound forming. Elements containing six or seven valence electrons are either retarders, *per se* or compound formers, with the exception of neutral tungsten and accelerating uranium. It has been pointed out already that in group VI the effect on graphitisation is related to atomic weight and/or atom size.

The metals containing a complete outer shell or eight electrons are accelerators or neutral, behaving somewhat like the adjacent sub-group I b. In this area there seems to be a tendency for the effect on graphitisation to decrease with atomic weight. It is quite possible that we must view the effects of boron and bismuth, which are used in traces only, from the viewpoint of nucleus formation. Indeed bismuth can scarcely exist in the metal in any other form. This mechanism for boron and aluminium is pretty well established since both these elements definitely increase the number of temper carbon nodules. A similar increase has been noted as an effect of nickel and of copper. Hydrogen, chromium, and molybdenum have been shown to decrease nodule number, but manganese, also a retarder, to increase it. None of these changes is so enormously marked as in the case of the accelerators boron and aluminium.

The accelerating elements in groups II, III and IV are also very active deoxidisers. One is prone to consider the formation of nuclei of their oxides as an important factor in explaining their effects on graphitisation. Manganese, however, is an active deoxidiser and apparently enucleates the metal it retards.

Barnett, under the author's direction, has shown[2] that graphitising rate may be proportional to the square root of the nodule number. The theoretical value would be the two-thirds power.[3]

(*Continued on facing page.*)

A FOUNDRY ON A STAMP

For the first time in philatelic history, there is a reproduction of a foundry on a postage stamp. It has been issued by New Zealand, and is the sixpenny value of the Peace issue, the vignette on the left being symbolic of industry at war, whilst on the right sheep farming represents peace.

GRAPHITISING ELEMENTS IN MALLEABLE CAST IRON

(*Continued from previous page.*)

Element Distribution

Of the limited number of elements investigated, silicon, chromium, and manganese seem to distribute themselves between iron and carbide in such a manner as to concentrate in the latter phase. This is true, however, of chromium and manganese only if the concentration of these elements is rather large—decidedly larger than it would be in white iron for conversion to malleable. For small amounts of manganese and chromium the distribution seems to be in the opposite direction.

Of the alloys favouring graphitisation, titanium, silicon, and aluminium restrict the gamma iron field. Chromium does also, a fact which Zener[4] regards as anomalous.

The elements manganese, nickel, copper, and zirconium expand the gamma region. Apparently little consistency can be found between the effects of the elements on graphitisation and effect on the gamma loop.

The effects on primary graphitisation, while not neglecting an effect on graphitising rate, cannot be studied without reference to susceptibility to supercooling which involves the question of how crystals begin to grow from the liquid, and cannot be discussed here.

Those elements which retard graphitisation must, in practical cases, be present in relatively small amount or produce pearlitic malleable. In the latter case their effects on mechanical properties are overshadowed by the effects of the retained combined carbon. That problem should be studied from the viewpoint of the relation of combined carbon in various metallographic forms to properties. The very active accelerators must again in practice be present in quite limited amount or mottling will be produced and the effect on mechanical properties is that of flake graphite and not of the particular alloy.

This leaves us with a very limited number of metallic alloys whose effect on mechanical properties could have any real interest. These are the slight retarders manganese, molybdenum, the accelerators silicon, copper, nickel, and cobalt and the neutral elements tungsten. The two last mentioned have not been attractive on economic grounds. Copper and molybdenum have been successfully used as described under these headings. The effect of silicon has been discussed under that heading. No formal knowledge has been available concerning nickel or the small range of manganese content which would not interfere with annealing.

It seems almost self evident that any of these elements should strengthen and stiffen ferrite. The observations regarding copper, molybdenum and silicon—the latter within a range consistent with graphitising conditions—at least qualitatively confirm this conclusion.

Mechanical Properties

Alloy elements might, of course, also affect mechanical properties by controlling the form and number of temper carbon nodules. These characteristics are, however, largely related to heat treatment. Schindler and Elliott, with the author,[5] showed that, in a given iron, decreasing the nodule number per mm.[6] from 41,000 to 135 altered the tensile strength but little, but a further decrease to 30 increased it 2,000 or 3,000 per sq. in. A reduction in the number of nodules per unit volume, however, increased the elongation. At an average nodule number of 35,000 per cubic mm. the elongation was about 14 per cent. and at an average of 80 about 21 per cent. An acceleration of annealing rate due to an increase in nodule number may be accompanied by corresponding effects.

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CHANGING SCRAP METAL PRICES

By "ONLOOKER"

For some time past it has been the custom of the Ministry of Supply, Disposals Section, to issue its list of scrap metal selling prices once a quarter, with the proviso that these could be withdrawn or altered at short notice. When, therefore, at the end of March it was announced that the new schedule would cover only one month, people pricked up their ears and wondered what was coming. As everyone knows, the official quotations for lead, zinc and copper were raised on April 8, the increases ranging from £6 to £10, but even so, zinc and lead still remain below the world price. On the whole these adjustments in value were fairly well received and approved. Not unnaturally, it was expected that the announcement regarding the virgin prices would be accompanied by news of the revised scrap metal values, but it took the Ministry of Supply four days to give this information to an expectant public—a lapse which brought many caustic comments from the trade. It must be presumed that the disposals side of the Ministry knew in good time of the upward adjustments in the virgin metals; after all, these changes were canvassed for months in advance by merchants, dealers and consumers. Why, then, was the announcement relating to the fresh set of secondary metal values not made concurrently with the new Order relating to the virgin metals? The result of the lapse was that business hung fire until the new set of prices was published.

A Poor View!

It had been anticipated that in view of the all round higher price level for virgin metals, the margin between that grade and scrap would be widened, and scrutiny of the revised official quotations confirms that some concessions have been made, confined almost entirely to 70/30 material. In rod scrap and brass swarf the change is rather the other way, for the increase in the cost of these types is more than the increase in terms of the rise in the virgin metals. In unalloyed copper products, such as old shell bands, £9 10s. has been added to the value of the scrap, the concession therefore being only 10s. On the whole the reaction of the trade to the new set of values was not favourable, and it is felt that if the Government wish to do all in their power to encourage the use of scrap, then they have missed an opportunity to offer additional inducement to consumers. It now looks very much as if there will be another increase in the price of virgin copper in this country, the time and extent being uncertain. This will give the authorities another chance, if they care to take it, of "baiting the hook" by widening the differential between the quotations of old and new metals, and in this matter it should be borne in mind that the Ministry, as the largest single seller in this country, is the authority which sets the price standard for the trade in the United Kingdom. There cannot be any doubt that the non-ferrous industry ought to melt all the secondary metal it can, for the copper position is not by any means a happy one, and in any case it is in the best interests of the nation to cut down imports to the lowest possible level.

Ex-works Prices Disliked

It is perhaps a little unfortunate that the Ministry sticks rigidly to the principle of offering Government scrap on an "ex-works" basis, for buyers are finding themselves involved in certain difficulties which in the aggregate increase quite appreciably the cost of the material to the consumer. It will be appreciated that much of this "disposals" scrap is lying at depots in the open, and on ground which in wet weather may not provide the best facilities for putting in lorries. Inevitably the staff at the disposal of the Ministry is limited, and there is the chance of delay in getting the vehicle alongside the pile from which the scrap has to be drawn. There are possibly other factors too connected with the packing of the material which increase handling costs in the foundry, so that one way and another it can be seen that the buyer may find himself involved in additional charges which can make the margin between his buying price and the value in terms of new metals look rather foolish. There is, of course, always the question of melting loss where scrap is concerned, and since this must be looked at on a percentage basis it is obvious that when prices rise the reckoning in respect of loss grows heavy in proportion to the prime cost of the metal. These are all matters which the Government officials responsible for fixing selling prices should ponder and review in the light of their desire to ensure that the manufacturers absorb the highest possible tonnage of secondary metal.

Ample Scrap Supplies Available

One can be fairly certain that there will be plenty of scrap available in the world for many years to come in view of the tonnage of material left over after the war. What is not quite so certain is how this scrap will be handled by the governments concerned. In the United States there is an inclination to go in for stock-piling, but there is much uncertainty about how things will "pan out" in the long run. Here, in the United Kingdom, it is generally understood that the Government will place scrap freely at the disposal of the consumers, and indeed this is actually going on all the time through the medium of invitations by tender as well as direct sales by the Disposals Section of the Ministry. The point is, of course, that the consumers of scrap in Britain should be supplied with just the amount of secondary metal they can absorb, and it is of no avail to press the using trades to take more. Every manufacturer knows the dire results of introducing too much secondary metal into his melts, for what happens then is that the finished article deteriorates. Before the war ended there were fears that the vast accumulations of scrap would press heavily on the market, depress virgin metal prices and put the metal merchant out of business. These gloomy anticipations have not been fulfilled and there does not seem to be any reason to expect trouble in the future. Much depends on the wisdom of the Ministry of Supply, but there is no reason to think that the officials will not continue to discharge their duties with zeal and discretion.

LONDON PATTERN-MAKING SHORT PAPER COMPETITION

REVIEWED BY MR. B. LEVY

The council of the London branch of the Institute of British Foundrymen are to be congratulated on the success attending their choice of a subject for competition, as there were 10 entries for the short Paper competition on pattern-making. This remarkable number of entries underlines the popularity of the subject and shows how important patterns are becoming to the foundryman of the future. The papers, read by Dr. Everest, are reviewed in their order of presentation.

MR. JOHN B. BOYD wrote generally on the subject and advocated perspective sketches to assist co-operative action for the foundrymen who are not well able to read ordinary machine drawings. He also described a method of setting cores off two faces at right angles all else being clearance and using these two working faces for checking and setting the plates. In the latter case a pair of parallel strips were employed to rest against the two working faces.

MR. A. T. GOODCHILD described a similar pattern for a Diesel air valve having complicated cores. This Paper was perhaps a little difficult to follow when read at the meeting even though an illustration was circulated. The essence would appear to be a layer system of core assembly having as its keynote the production of ten simple cores in place of one complicated core, the only disadvantage of the core-assembly being in a growth of the over-all measurement which was overcome by trial and error in the experimental stage. A minimum of inspection was necessary only for production of quantity castings. The Paper seemingly outlined a simplified method of corebox construction for a particular purpose.

A "Necessary Evil"

MR. H. D. SPENCE dealt with patterns in a general manner deprecating the use of old and obsolescent machinery for pattern-making, mentioning that some firms still look upon the pattern shop as a "necessary evil." He also stated a particular case showing how new pattern equipment reduced the selling price of castings from an original 3s. down to 1s. 11d. each for an outlay of £8 on the new equipment, thus proving an economical case for good pattern equipment even though in his quoted instance the quantity of castings was merely 200.

MR. G. S. F. MURRAY, whilst dealing with patterns in a general manner, wrote of the possibility of competition with plastics in the near future and the consequential necessity for high class pattern equipment to compete with the finish, etc., of plastics. His conclusions were that first-class metal patterns and coreboxes were to be the foundryman's equipment of the future, and suggested zinc or nickel spraying of wood patterns as a temporary alternative to the metal pattern equipment. Mention was also made of metal spraying cast iron patterns to obtain better finish. Here the reviewer would comment that he has found that peeling off in storage and handling has been found a great disadvantage with metal-sprayed cast iron patterns.

Difficulties in Pattern-making

MR. ROBERT HIGGINS dealt in an overall manner with pattern-making, drawing attention to the many difficulties encountered by the pattern-maker such as indistinct prints or drawings, permissible amount of taper and the information relating to quantities of castings expected off the pattern equipment. He described a method of making very large bedplates in sections with the object of varying the pattern from the flate plane to produce camber which would appear to be a very useful system on such work. Reference was also made to recognised methods of transferring load from moulding-shop to core-shop by placing suitable patterns in a corebox.

MR. H. W. TURNER'S entry, following that of Mr. Higgins's, was written on somewhat similar lines as those of previous writers dealing with patterns generally. Liaison between foundry and pattern shop was stressed as having important effect on the production of good castings, and the adverse effect of the buyer being the sole arbiter in such matters.

MR. R. T. ROUNCE presented a Paper on pattern storage which, whilst not strictly in line with the title of the competition of pattern-making, brought out such useful points as the profitability and value in taking care of pattern equipment. A simple method of categorising patterns was mentioned, together with some well-known systems of shelving. A rather interesting note was that referring to the use of dowels to allow clearance of dirt from used pattern equipment.

MR. V. C. WARREN described the production of a double-sided cast-iron pattern plate and the value of co-operation between moulder and pattern-maker in effecting the result. The type of equipment produced by the methods described in this Paper would apparently be of the cast-in-one integral plate and pattern which would merely be file finished after casting. A number of recognised points regarding coreprints, fillets and gauges were also laid down as essential to the production of the correct job.

Prize-winning Entry

MR. A. M. WHIPP, who won the first prize, dealt with metal-faced wood patterns and coreboxes by the letting-in of strip brass, etc., giving examples of the large quantities of castings obtainable from such reinforced patterns. An outline was given of some principles to observe when adding strip or sheet brass, notes also being made of the time-wasting effort in the foundry to rub cores when patterns become worn through lack of this reinforcement. Six typical sets of pattern equipment were listed, each of which had been made with brass bosses, pads, ribs and strip, as additional wearing faces to ordinary hardwood equipment, and the quantities of castings produced off each type of pattern was given.

The reviewer's Paper was the last to be read, dealing broadly with cost relation of patterns to the foundry casting and final production. Examples were quoted of the low cost of strickle boards and cheapwood patterns for one off jobs compared to the increased expenditure necessary for larger scale production. Pos-

(*Continued on page* 167.)

HIGH QUALITY STEEL CASTINGS—RUHRSTAHL A.G., ANNEN

Dr. H. Sulton, of the Ministry of Aircraft Production, reporting to the Combined Intelligence Objectives Sub-committee on behalf of a team of four experts, has made the following statement:—

The works was stated to be an old-established one which had been improved since 1936 by a series of changes and extensions. It was now a very large works having had about 5,000 employees (of whom nearly half were foreigners) up to the time when work had to cease owing to failure of power supply. There was no damage to the plant or buildings by bombing; no HE bombs had fallen on the plant.

Production

The main products of Ruhrstahl Annen Works in recent years have been:

(*a*) Steel castings for use in aircraft and aero engines.

(*b*) Die blocks for propeller blades, for use in hydraulic presses.

(*c*) Castings for marine application, U-boat decks, diaphragms of U-boat motor crankcases, exhaust gas valves.

(*d*) Castings for tank tracks, tank wheels, armour plates for protection of tank gunners, gearboxes of tanks and armoured vehicles, parts of ventilators for tanks.

(*e*) Castings in high alloy steels of corrosion-resisting and heat-resisting types for special purposes, chemical plant, etc.

The works was producing about 5,000 tons of electric steel per month (3,200 for steel castings, 800 for steel forgings, 1,000 for steel ingots—for use at other works). About 200 tons per month of acid open-hearth steel was imported from other steelworks to meet requirements for ingots, over 12 tons. About 1,300 tons per month of liquid steel was used for pouring castings for aircraft, yielding about 200 tons per month of finished castings. For castings for marine applications, including submarines, 1,000 tons of liquid steel per month was used to obtain 550 tons per month of finished castings. For stainless steel castings 80 tons per month was used to obtain about 40 tons per month of finished castings. For tank tracks, 900 tons per month of liquid iron was used for the pouring of about 460 tons of castings. The smaller yield of finished castings from the liquid steel used for the production of aircraft castings was due to the scrapping of castings for small defects of various kinds and liberal use of metal in runners and risers.

The special feature of the work at Ruhrstahl Annen is that only high-quality steel castings were made, and these were of electric steel made in either basic Heroult or high-frequency furnaces. No castings of ordinary commercial quality were made there. A list of aircraft castings that have been produced and the composition of castings of all kinds produced at the Annen works are appended.

Plant

The furnaces used for melting the steel for the castings made at Ruhrstahl Annen are:

One electric arc furnace (Heroult, basic) of 1 to 1.5 tons capacity.
Two electric arc furnaces (Heroult, basic) of 6 tons capacity.
One electric arc furnace (Heroult, basic) of 8 tons capacity.
Two electric arc furnaces (Heroult, basic) of 14 tons capacity.

Another 8-ton furnace was in course of construction. In these furnaces Ruhrstahl preferred to use graphite electrodes, the Soderberg electrode not having proved so suitable as it resulted in some difficulty in obtaining sufficiently hot metal.

Two induction furnaces of 6 cwt. and 12 cwt. capacity were used for melting highly-alloyed steels. From the melting furnaces the steel was conveyed to the moulds in ladles lined with Chamotte. The production was organised so that four separate foundries covered particular fields.

Shop No. 1.—In this foundry cement-sand (Randupson) moulds were used. Instead of being allowed to stand at normal temperature to harden before use, the moulds were heated for 6 hrs. in a furnace, after which they were ready for use. For casting a new type of cylinder for BMW801 (air-cooled radial aero engine), a simple cylindrical mould was spun on its own axis, and the cylinder cast centrifugally. The finning of the cylinder was a subsequent operation and it was stated that thin steel strip was used for making the fins.

The three sections of the radial aero-engine BMW801 crankcase, formerly produced as steel forgings had more recently been in production as castings poured in cement-sand moulds centrifugally. The moulds were assembled in strong iron boxes with a single central runner at top centre, and spun on a vertical axis. In this foundry also, miscellaneous castings of fairly large size for tanks and submarines had been in production, cement-sand moulds being used.

Shop No. 2.—In this foundry high-alloy steel castings in corrosion-resisting and heat-resisting steels had been made. Owing to scarcity of alloy elements the tonnage of the castings had been smaller than that of other sections, but some 80 tons per month of molten alloys or alloy steels had been used to produce about 40 tons of castings.

Shop No. 3.—In this foundry tank track units had been mass-produced on an extensive scale, 900 tons of liquid steel per month having been used to obtain about 460 tons of finished castings.

Shop No. 4 was used for aircraft steel castings, 1,300 tons of liquid steel having been used per month for 200 tons per month of finished castings.

Heat-treatment

Many of the castings were heat-treated in rotary electric furnaces which made one complete rotation in 2 hrs., the period of soaking at the hardening

temperature of 800 to 860 deg. C. A good many of the high-strength castings were water-quenched in the hardening treatment, *e.g.*, the sections of BMW801 crankcase which was water-hardened from 800 deg. C. and afterwards tempered at 500 deg. C. The production of undercarriage fittings for FW190 had been at the rate of 2,200 sets per month. Other heat-treatment muffles were also used, the heat-treatment plant being modern and efficient throughout.

All four foundries were relatively free from mechanical handling gear. It would appear that a large amount of manual labour and good technical control had been used to obtain a good rate of production of high-quality castings. On the other hand, for finishing the castings a complete machine shop containing a full complement of modern lathes, milling machines, planers, etc., well over a hundred, was provided for machining the castings. A very large capital expenditure had been entailed, but the management claimed that it had already been recovered in ten years of operation.

Inspection

The main methods of inspection are:—(1) Visual; (2) magna-flux; (3) hot oil soak; and (4) radiology; in addition to pressure tests of castings for use under pressure. All aircraft castings were subjected to tests (1), (2) and (3), and usually 10 per cent. of production castings were radiographed. Other castings were cut up for tensile tests on fully machined test-pieces, usually about one in a hundred or at least one per cast. Small defects were made good by welding with the electric arc or atomic-hydrogen torch, without pre-heating, and before final heat-treatment of the castings.

Laboratory.—The laboratory contains a full set of testing machines, including standard types, creep-testing units, fatigue-testing machines, apparatus for notched-bar impact tests at temperatures down to −180 deg. C., and radiographic units (two), also experimental melting, casting and heat-treatment facilities.

Economic Aspects.—It was mentioned that the relatively small amount of scrap and discard entailed in the production of the high-quality steel castings had been a powerful argument in favour of the use of castings in place of forgings, *e.g.*, the production of one of the sections of the BMW801 aero-engine crankcase in forged steel required 260 lb. of molten metal and for production of the same part as a centrifugal casting, only 80 lb. was required. This particular casting is a centrifugal casting and in such castings less metal is required than for statically-cast items.

A PARTY OF NORWEGIAN iron and steel workers made a two-day tour of North-East industrial establishments on June 11 and 12.

DETAILS OF THE LINCOLN FOUNDATION $200,000 award programme, covering prizes for technical Papers on welding can be had by writing to Dr. E. E. Dreese, chairman, Board of Trustees, The James F. Lincoln Arc Welding Foundation, Cleveland, Ohio.

INCOME TAX AND PATENTS

By F. J. TEBBUTT

The incidence of income tax as regards patents has been very confusing, but the Income Tax Act, 1945, has clarified the position and as this act became effective from April 26 last, this article may be usefully noted.

Until these new provisions, an outright sale of a patent for a lump sum that was not assessable, was treated as capital, although if a lump sum was paid for a use of a patent, that sum was assessable, and, of course, any income of the inventor from an invention (*e.g.*, royalties) is assessable.

By this new law if capital is expended in the purchase of rights, an annual allowance off this amount against tax is obtainable, the full amount being spread over 17 years, although if another period is substituted that period will apply instead of the 17 years. In ordinary cases the legal life of a patent is 16 years (in special cases there may be extensions) so the position is that tax paid on any capital amount for a patent will be allowed for during the life of the patent.

The vendor is liable to tax on the capital amount received, but this can be spread over, by yearly payments, the spread-over, however, not being 17, but six years; if the taxpayer prefers, he can be assessed for the whole sum in the year of assessment in which the amount is received.

Where a case may concern a royalty or lump sum in respect of a past user of a patent, the tax can be spread over six years; if the period under review is less than six years but more than two years the spread-over would operate over the proper number of years.

LONDON PATTERN-MAKING COMPETITION

(*Continued from page* 165.)

sible future requirements when planning expenditure on initial wood equipment was emphasised, especially in regard to probability of plate moulding. An example in cast-tooth gears was also given showing the benefits accruing to expenditure on first-class metal patterns properly machined as compared with the "filed-up" type of job.

The general theme was that pattern costs should always be considered on the anticipated quantities of castings required, to enable both pattern-maker and moulder to give of his best. Most writers made mention of the value of co-operation between pattern shop and foundry, which undoubtedly is an asset to the industry generally.

THE DIRECTORS OF Beyer, Peacock & Company, Limited, locomotive builders, etc., of Gorton, Manchester, intend, subject to Treasury consent, to make an issue of share capital in the near future for the purpose of redeeming the outstanding debenture stocks and to provide additional funds for the re-equipment and expansion of the business. The debenture stocks outstanding amount to £104,832. The issue will be offered to the ordinary shareholders on a *pro rata* basis.

QUALITY CONTROL CHART

(*Continued from page* 161.)

is now consistent a simple adjustment to the mix would be all that was required.

Again utilising the same points as illustration of variation in total carbon. The breakdown of control after the first five points might be due to such factors as coke quality, weighing or charging, or alteration to charge constitution, particularly steel quantity or quality, or to marked variation in blast control or tapping practice. Reference will, of course, be made to the subsidiary chart to see what changes, if any, have been recorded on the first group showing breakdown of control. Still for sake of illustration let it be assumed that there were three such changes indicated. Reference to the records showed that these changes were (*a*) coke from reserve stock, (*b*) mixed steel bar ends in place of steel rails, and (*c*) change of personnel charging. The steps that would be taken then are fairly obvious, namely—immediate checking of steel and coke available and supervision of charging operations. As a result of such attention, for instance, improved charging, a fresh supply of coke being used, but the steel could not be changed. The resultant points indicate that control had been restored, but in view of the trend shown in the averages slight adjustments to either charge composition or metal to coke ratio were necessary to eliminate this trend.

Revision of Control Limits

Although not shown on the specimen chart variations in mechanical properties begin to show up more prominently with variations in analytical results and it is thus possible to take more positive action in the maintenance of the material to specification. Furthermore, as the degree of control is improved it is always possible to revise the control limits and either reduce the variation or increase, say, the mechanical properties, thereby making a considerable improvement in the quality of the material. Thus it will be seen that the "quality control chart" is not merely a short term means of overcoming immediate foundry troubles but has a long term value in the analysis, interpretation and constructive use of scientific records. The value of any collected information lies not in its collection but its application.

PRODUCTION EFFICIENCY SERVICE

The difficulties of post-war production and administration of industrialists and manufacturers are to be catered for by the Production Efficiency Service set up by the Board of Trade.

Assistance is to be given in establishing efficiency in such factors as layout, progression of operation, internal organisation of stores and material, transport, production lines, packing and despatch, administration, statistics, accounting and costing, and oncost control, etc.

The service is gratis and available to any firm. The address is:—Production Efficiency Service, Board of Trade, Waterloo House, Waterloo Street, Birmingham.

RESOURCES OF THE EMPIRE

MR. MORRISON ON PREFERENCES

"The Trade and Resources of the Empire" was the subject of Mr. Herbert Morrison's address at the Imperial Press Conference last week. He said that all agreed that the more the Commonwealth and Empire traded together the better it would be for everyone, but we could not always agree on the methods of achieving the increase of trade. Regarding the war effort, Mr. Morrison said that steel output provided a useful index of the growth of industrial resources. Between 1938 and 1943, steel capacity increased by 50 per cent. in Canada, 50 per cent. in India, 65 per cent. in Australia, and nearly 20 per cent. in South Africa. The vast resources of the Commonwealth had increased wonderfully during the war years. We must now see that they were fully employed for the benefit of mankind in peace.

H.M. Government had reached agreement with the United States on the broad principles of future commercial policy, Mr. Morrison continued. The steps being taken to facilitate trade were being planned on a world scale. One could not undo at once all the contracts and restrictions which hampered trade, because each had a different value for different countries, and what it might be easy for one to surrender would completely upset the economy of another. The aim was the reduction of barriers to mutual advantage.

Objective of International Trade

The speaker said that into the bargaining would come Imperial preferences, not as a system, but individually, just as individual tariffs. It was a crucial point. When it came to examining whether a particular preference should be reduced, the answer would be given by the country which afforded the preference only with the agreement of the countries which enjoyed it. There could be no question of Imperial preferences being given up as it were in the void. They would be examined as part of the wider commercial picture, and in the bargaining any reductions suggested would have to be weighed against the advantages to the Commonwealth and Empire as well as to the world of the countervailing reductions in trade barriers offered by other countries. The goal of international trade should be better living for all the peoples of the world, and we must make this not a catchword, but an object of positive policy.

U.K. ALUMINIUM PRODUCTION

Production of virgin aluminium in the United Kingdom in the first quarter of the year totalled 8,264 tons, against 7,890 tons in the last quarter of 1945, and secondary ingot production 11,358 tons, against 12,450 tons. Consumption of virgin metal amounted to 23,900 tons (22,000 tons) and of scrap 13,004 tons (17,900 tons). Imports were only 1,270 tons, against 12,920 tons. Imports in April (100 tons from Canada) had not started to reflect the contract recently arranged for the purchase of 215,000 metric tons from Canada during this year and next.

STANTON-DALE
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Manufactured to guaranteed analyses in seven standard grades. Also obtainable to individual specification

THE 14-TON CASTING ILLUSTRATED IS ONE OF A SERIES MADE IN A STANTON FOUNDRY FROM STANTON DALE IRON

1. Core being lowered into mould
2. Pouring the metal
3. Finished casting in transit

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STANTON IRONWORKS
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NEWS IN BRIEF

NEWMAN INDUSTRIES, LIMITED, have received permission to deal in £9,733 ordinary stock.

AS FROM JUNE 29 next, the address of the commercial branches of Westinghouse Brake & Signal Company, Limited, will be 82, York Way, King's Cross, London, N.1.

TANGYES, LIMITED, Cornwall Works, Smethwick, Birmingham, have reopened a branch office in Manchester at 5, Cross Street. Mr. J. G. Benwell will be the district manager.

COX & DANKS, LIMITED, iron and steel scrap merchants, etc., announce that the address of their East London branch is now Private Sidings, L.M.S. Railway, Devons Road, Bow, E.3.

NEW INDUSTRIES being attracted to the development areas under the Government-sponsored Scottish Industrial Estates, Limited, will provide employment for about 70,000 workpeople.

STOTHERT & PITT, LIMITED, of Bath, have secured a contract of nearly half a million pounds for supplying dockside cranes to the port of Santos, Brazil, for delivery in the next two years.

FOUR EMPLOYEES OF S. J. & E. Fellows, Limited, sheet-metal workers, hollow-ware manufacturers, etc., of Wolverhampton, with 215 years' service between them, have received presentations.

THE INLAND REVENUE DEPARTMENT has announced that firms making loans or gifts for the training of their employees at technical colleges are to receive allowances for income tax and other purposes.

PERMISSION TO DEAL in the £132,200 cumulative participating preference stock and £200,000 ordinary stock of Alexander Stephen & Sons, Limited, Glasgow, engineers and shipbuilders, has been granted.

IT HAS BEEN DECIDED that the difference between the engineering employers and the unions on the rate of payment to women in engineering doing what has normally been women's work shall be submitted to the National Arbitration Tribunal for decision.

A NEW TYPE of seamless rectangular-section tube for the shackle which holds the leaves of locomotive and wagon springs together has been developed at the Chesterfield works of Tube Investments, Limited. This new shackle facilitates quicker production, and is claimed to have greater strength and longer life than the pre-war shackles forged by blacksmiths.

TWO MILLION TWO HUNDRED THOUSAND workpeople in the United Kingdom had wage increases to the aggregate amount of £579,000 a week in April. Since the beginning of the year 4,178,000 workpeople have had increases of the total net amount of £1,419,000 a week. In the corresponding four months of 1945 there were net increases of £815,400 a week, shared by 3,393,000 workpeople, and a small decrease in the wages of nearly 4,000.

TO OPPOSE NATIONALISATION on grounds of prejudice was as wrong as to support it from "blind subservience to a theory," said Mr. Anthony Eden, M.P., speaking at Leamington Spa recently. The problems of industrial organisation must be studied with minds free from bias. Referring to the proposals of the Government to nationalise the iron and steel industry, Mr. Eden said that at the best the result could only be confusion; at the worst it might entail a national disaster. If ever there was a clear example of doctrine run riot, it was this.

THE DIRECTORS OF John Hetherington (Holdings), Limited, which is associated with Textile Machinery Makers, Limited, propose to convert the 450,000 7 per cent. cumulative preference shares into the same number of ordinary stock units of 5s.—holders surrendering their preference rights and arrears of dividend—and to write down to 6d. the 349,571 ordinary shares of £1 and to consolidate them into ordinary stock units of 5s. The subscribed capital would thus be reduced from £799,571 to £121,239. Meetings of shareholders to consider the scheme will be held on June 20.

LORD NUFFIELD, who has arrived back in this country after a five-months' tour in countries oversea, said that Great Britain now had the best chance she was ever likely to have of building up her export trade in Empire markets. That golden opportunity would be lost, he said, if increased labour costs at home continued to force up prices, which were already far beyond the pocket of the average buyer oversea. Britain could be more prosperous than she had been for a generation past if she worked to this slogan: "More production, better design and salesmanship, lower prices."

SPEAKING AT THE recent annual meeting of Vosper, Limited, engineers, ironfounders, etc., Admiral Sir George Chetwode (chairman) said that owing to the fact that the Camber shipyard was razed to the ground by enemy action early in 1941, they had had an opportunity to replan and reconstruct this yard, making far better use of the space available and, at the same time, ensuring that the best possible equipment was used. As a result of these measures the productive capacity of the yard would be at least doubled if not trebled, and they anticipated that the increased production would be met by an adequate demand for many years to come.

IN CONNECTION WITH the housing programme they had developed a tubular-steel roof truss which was being used both in the temporary house known as "Arcon," in the design of which they were concerned, and in a permanent house designed by the British Iron and Steel Federation, which was now coming into production, said Mr. A. G. Stewart (chairman), speaking at the annual meeting of Stewarts and Lloyds, Limited, on June 4. In all, orders for roof trusses had so far been received for 41,000 temporary houses and 30,000 permanent houses, involving over 17,000,000 ft. of tubing, a large part of which was also manipulated and welded by them. Their exports of tubes for the first three months of this year exceeded the average for the years 1937 to 1939.

THE BRITISH STEEL FOUNDERS ASSOCIATION—B.S.F.A.

—is an organisation which represents the combined technical resources of the Steel Founders of Great Britain. Its library, research and statistical departments are at your service. If you use or are likely to use steel castings, in any form, your address (private or business) should be on the B.S.F.A. bulletin list.

BSFA
STEEL CASTINGS

Longleys

PERSONAL

MR. B. C. TALBOT has been appointed a director of Cargo Fleet Iron Company, Limited.

CAPT. C. A. KERSHAW has been appointed secretary-general of the Engineering Industries Association.

MR. J. WILSON PERRY has been appointed a director of the John Thompson Engineering Company, Limited, Wolverhampton.

MR. MARTIN JACKSON has retired after 56 years' service with R. & W. Hawthorn, Leslie & Company, Limited, Hebburn.

COL. P. H. GOUGH has been appointed a director of Glynwed Tubes, Limited, and of each of the subsidiary companies—Wednesbury Tube Company, Limited, and Glynn Bros., Limited.

SIR CLAUD D. GIBB, chairman and managing director of C. A. Parsons & Company, Limited, engineers, turbine makers, etc., of Newcastle-upon-Tyne, has been elected to the Council of King's College, Newcastle.

MR. BERNARD T. BARKWELL has been appointed general works manager of the Refractory Brick Company of England, Limited. MR. A. L. BRADLEY is now engaged full time on new developments within the Steetley group of works.

MR. G. S. WOOD and MR. R. F. STAGG have been appointed local directors of Thos. W. Ward, Limited, Albion Works, Sheffield. Each is a son of a joint managing director, the former of Mr. George Wood, who is also deputy-chairman of the company, and the latter of Mr. F. R. Stagg.

MR. GEORGE WANSBROUGH, who has been appointed a director of the Bank of England in succession to the late Lord Keynes, is chairman of A. Reyrolle & Company, Limited, and of Bren Manufacturing Company, Limited, and a director of a number of companies, including C. A. Parsons & Company, Limited, and Pyrotenax, Limited.

MR. GEORGE CLARK, who recently completed 53 years' service with the Bryan Donkin Company, Limited, Chesterfield, of which he is chairman, has been made an Honorary Freeman of the Borough. Mr. Clark is also chairman and managing director of British Furnaces, Limited, a director of Farrar Boiler Works, Limited, and managing director of Smith Bros. & Company (Hyson), Limited, Nottingham.

DR. F. D. RICHARDSON, who, during the war, played an important part in the development of new weapons for the Royal Navy, has recently been appointed as head of the chemistry department of the British Iron and Steel Research Association. He is a graduate of University College, London, and one-time Commonwealth Fellow at Princeton University, U.S.A. His researches have been in physico-chemical fields.

MR. RANDAL G. KINCAID, who has been chairman and managing director of John G. Kincaid & Company, Limited, marine engineers, etc., Greenock, since 1940, has resigned the position of managing director, but retains the chairmanship. MR. ALFRED DAVIS and MR. ROBERT GREER have been appointed joint managing directors. MR. GEORGE E. CARTER, who has been a director of the company for over 20 years, has retired from the board.

STEEL PRODUCTION IN EIRE

Irish Steel, Limited, have recently commenced the manufacture of steel ingots of mild and special qualities, principally from scrap metal obtainable in Eire. One of the company's 35-ton open-hearth furnaces of the Siemens-Martin type, which was completed last year, has now been put into operation, the skilled technicians required to operate it having been secured. A second furnace of the same type will be completed in the near future. The ingots produced are converted into billets and subsequently rolled into various sections of merchant steel. The steel sections produced include reinforcing bars suitable for the building industry, together with steel suitable for the manufacture of agricultural machinery, nuts and bolts, horseshoes, bedstead angles, etc.

Hitherto the company was dependent on the meagre supplies of billets capable of being imported into Eire for the manufacture of merchant bars. Steel can in future be manufactured mainly from scrap—a raw material obtainable in fairly large quantities in Eire.

TO AVOID INFLATION

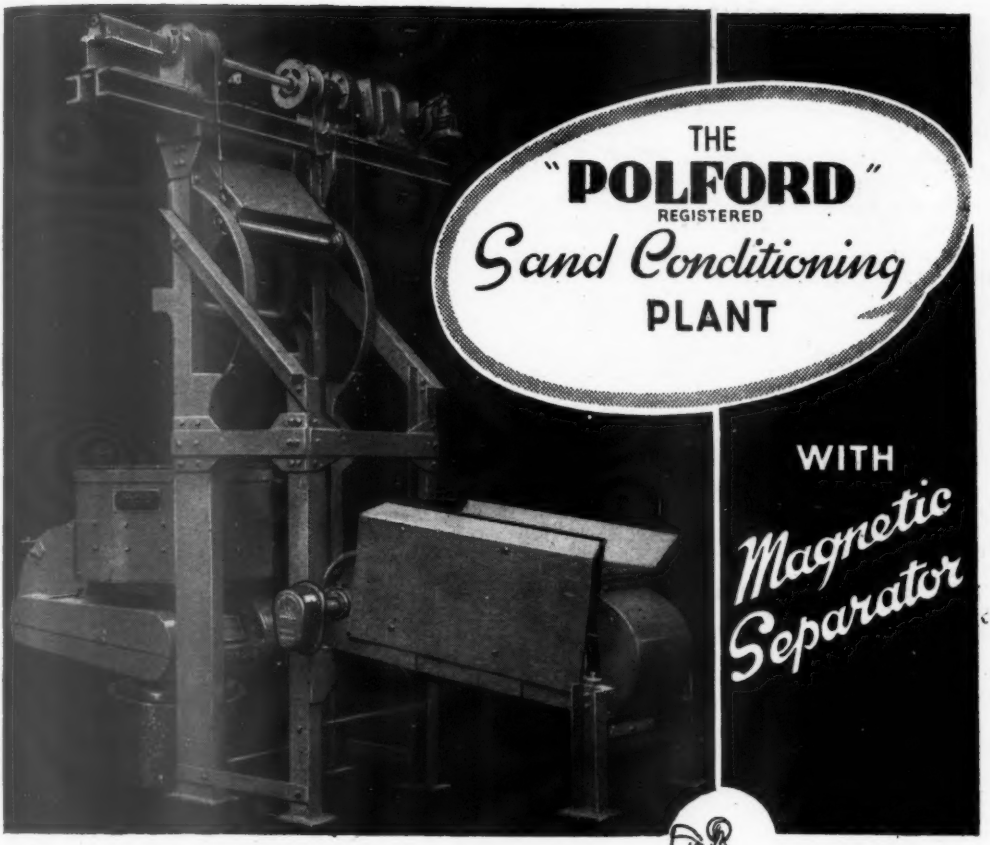
Sir John Anderson, when he addressed the conference of the Building Societies Association, indicated measures by which he believed inflation could be avoided, and said that to assist that end the Government should review their policy. The need to prevent inflation was just as great now as it was during the war, he said. We needed to increase our productive efficiency by every possible means and to get more goods into the home markets without prejudice to the building up of our export trades. Essential price and rationing controls should be maintained until equilibrium had been reached. There was only one way in which the standard of life could be raised, or even maintained, and that was through increased productive efficiency. Sir John said the Government were setting their feet upon a very slippery slope and the latest and most hazardous step was taken when they announced their wholly unwarrantable decision to nationalise the iron and steel industry, which was the very foundation of our national prosperity.

EMPLOYMENT IN INDUSTRY

Men have gradually been taking the place of women in industry since the end of the war, according to employment figures for separate industries given in the "Ministry of Labour Gazette." In the metal and chemical industries, however, there are still very many more women than in 1939. Employment of men, on the other hand, though in such groups as engineering there was a fall after last summer, is now showing an increase in most cases.

MEMBERS OF THE Engineering Society of Leyland Motors, Limited, are to visit the works of John Summers & Sons, Limited, Shotton, Chester, on Monday next. This is the first of a series of works visits to be made during the summer.

PAT. No. 570997.



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NEW COMPANIES

("Limited" is understood. Figures indicate capital. Names are of directors unless otherwise stated. Information compiled by Jordan & Sons, 116, Chancery Lane, London, W.C.2.)

Dufty Engineering Company, Fleet, Aldershot, Hants—£1,000.

Colloby Engineering Company, B53, Price Street, Birmingham—£2,000. L. Colloby.

Howell & Botham, 90, Queen Street, Cardiff—Engineers, etc. £1,000. J. F. Howell and H. J. Botham.

Dalex (Engineers), Brookley Road, Brockenhurst, Hants—£1,000. D. H. W. Alexander and C. J. Wilding.

T. & J. Webster (Ironfounders), 60a, Devonshire Place, Liverpool, 6—£1,000. T., J., and T. Webster, jnr.

W. West (Engineers), Camber Road, Rye, Sussex—£1,500. W. West, H. L. Goodwin, and M. E. Ades.

Crowcroft Engineering Company, 33, Brazennose Street, Manchester, 2—£2,000. N. Pickford and J. Clegg.

British Metal Fabrications, 11, Waterloo Place, London, S.W.1—£1,000. P. V. Rutledge and E. R. Fuller.

C. T. Instrell & Company, 3, Hingston Road, Torquay—Engineers, etc. £2,000. C. T. and A. S. Instrell.

South Berks Agricultural Engineering Company, Hermitage, Berks—£10,000. E. N. Baker and H. G. Perrett.

Martin & Hewitt, 108a, Town Street, Rodley, Leeds—Light engineers, etc. £1,000. C. J. Martin and G. W. Hewitt.

Weller Bros. (Mouldings), 8, South Side, Clapham Common, London, S.W.4—£1,000. C. D. and S. T. Weller.

Hull Precision Engineering Company, 33, Mortimer Road, Mitcham, Surrey—£100. G. Hamming and A. J. Penfold.

Loy Metal Components, 327, Hook Road, Hook, Surbiton—£1,000. W. S. H. Osborne and F. W. Gravett.

Nathan Brown (Engineering), Wharf Street, Dukinfield, Ches.—£2,000. N. and I. Brown, and S. W. Rothwell.

Walmor Engineering Company, 211, Victoria Road, Birmingham, 6—£3,000. A. H. Wallace and W. B. Passmore.

Modern Tooling & Engineering Company—£1,000. P. J. Saunders, 116, Fenchurch Street, London, E.C.3, subscriber.

John F. Thomas, 139/142, Copthall House, London, E.C.2—Manufacturers of metal products, etc. £1,000. D. I. Kaye.

Advanced Pressure Diecasting Company, 249a, Dudley Road, Birmingham, 18—£2,100. W. Milne and P. E. Dunn.

K. & H. Patent Products, 245, Oxford Street, London, W.1—Manufacturers of metal goods, etc. £1,000. J. E. Lowies.

Goodlaw Engineering Company, 98, Hertford Road, London, N.9—£500. J. V. Lawler, G. A. Rowley, and A. J. Knight.

T. F. Williams (Engineers), Cleveleys Avenue, Cleveleys, Lancs—£2,000. H. S. Edwards, T. F. and E. J. Williams.

William Townson & Company (Denton), 3, Bond Street, Denton—Engineers, etc. £3,000. W. Townson and D. Harrop.

North Wales Agricultural Engineers, Pennant View, Rhuallt, Flint.—£9,000. A. H. Brown, A. E. Clouds, and H. E. Jones.

Mechanair, 1068, Warwick Road, Birmingham, 27—Mechanical and general engineers, etc. £1,000. J. E. Kavanagh.

Lye Metal-Crafts, Valley Road, Lye, near Stourbridge—£2,000. S. G. Nightingale, W. H. Hill, and J. F. Cartwright.

Benz, 46, All Saints Road, Northfield, Kent—Engineers, etc. £1,500. J. and J. S. Hafner, W. J. and H. F. Waghorn.

R. A. Bone (Metal Workers), Seager Place, Burdett Road, London, E.3—£6,500. J. C. Corsan, R. A. Bone, and F. W. Baker.

S. B. Galpin, 4a, Allenby Street, Scunthorpe—Engineers, etc. £2,000. S. B., E. and K. J. Galpin, and E. M. Scupholme.

Redfield Diecast Motors, 107a, Church Road, Redfield, Bristol, 5—£1,500. R. J. Stradling, J. Canner, and C. G. Hendy.

United Metal Electrodes & Welding Equipment, 14, Howick Place, London, S.W.1—£10,000. B. Turner and L. J. Yeoman.

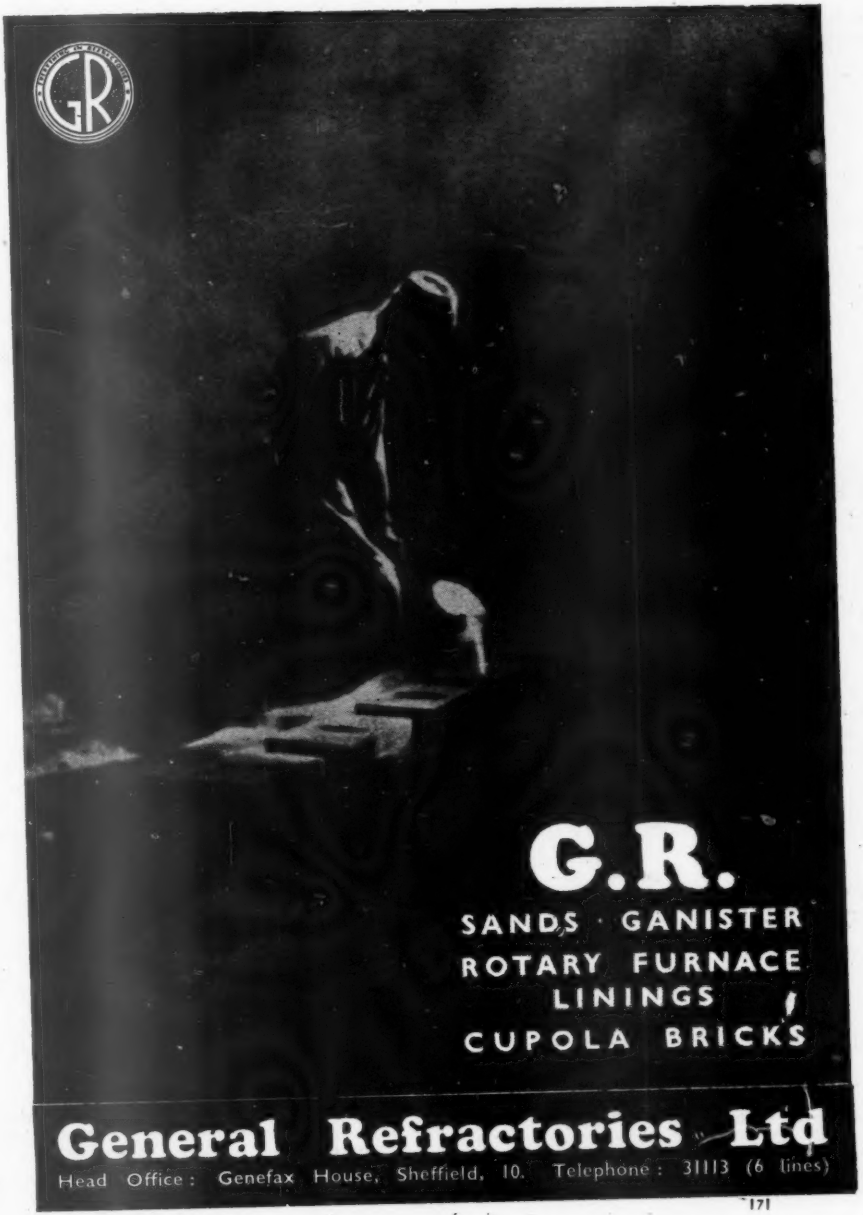
A. E. Rofe & Sons, Darenth Road, Dartford, Kent—Iron and brass founders—£1,000. A. E., E. R., C. E., R., and A. E. Rofe.

OBITUARY

MR. ROBERT HODGE, manager for 24 years of the Bristol office of Metropolitan-Vickers Electrical Company, Limited, died recently. He was born in 1881.

MR. ARCHIBALD J. H. MOWBRAY, who has died in Dorset at the age of 76, retired from the position of managing director of Smith & McLean, Limited, sheet and bar rollers, of Glasgow, in March, 1935.

MR. JOHN J. WALKER, senior partner in the firm of George Walker, Sons & Company, iron and steel, machinery, and scrap merchants, of Chapelside, Airdrie, has died after a long illness. He was 72 years of age and had been associated with the company for 58 years.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Raw Material Markets

IRON AND STEEL

Whereas the blast furnaces were kept going over last week-end, time was lost at the foundries and the steel-works due to the holidays. Last week's announcement of prospective increases in railway charges was not welcomed in iron and steel producing circles, and it is suggested that the higher costs will have to be borne by the consumer.

Blast-furnacemen are pressing for still bigger supplies of native and imported iron ores, but they are reasonably well supplied with coke, and production of pig-iron approximately balances with current consumption. Demand for high-phosphorus and basic iron is most insistent, but the general engineering and speciality foundries are also absorbing bigger tonnages of low- and medium-phosphorus, hematite and refined irons.

Maximum tonnages of sheets, strip, light sections and small bars are on order and, in consequence, there is no abatement of the heavy demand for sheet bars, slabs, blooms and billets. Pressure on home producers is, in fact, increasing, as overseas sources of supply appear to be drying up. All the billet mills are working to capacity and deliveries of sheet bars barely suffice for current requirements.

The flow of specifications and inquiries for steel plates has assumed the proportions of a deluge. Requirements of the shipyards and wagon builders, for example, have never been so formidable, and it is manifest that satisfaction of the clamant needs of other British industries will involve severe restrictions on the tonnages allocated for export. The position at the heavy section mills is not quite so tight, but here also there is an abundance of work in hand and bookings already in hand for colliery and railway equipment will absorb most of the output for Period III. In the sheet trade the congestion of orders is even more acute. Heavy export orders have been turned down and deliveries are now heavily in arrears.

NON-FERROUS METALS

Tin consumption figures for the first quarter of the year reveal an appreciable expansion over the corresponding period of last year. The January-March, 1946, total was 7,528 tons, against 6,480 tons in the last quarter of 1945 and 6,225 tons in the first quarter of that year. Consumption in March last at 2,150 tons was the highest since 1942.

The Combined Tin Committee has announced additional allocations for the first half of 1946 totalling 9,476 tons. They include 2,840 tons to France, 2,350 tons to the United States, 1,07 tons to Canada and 640 tons to India. The balance is distributed among other European, Middle East, and Latin-American countries.

A Departmental Committee is shortly to be appointed by the Minister of Fuel and Power to examine the future of the Cornish tin-mining industry. Present production is derived from the South Crofty and Geevor mines only. Costs of production have increased appreciably during the war years, while the shortage of skilled labour has become acute.

There was a considerable increase in zinc consumption in the first quarter of the year, the total being 66,745 tons, compared with 58,305 in the last quarter of 1945. Consumption in the corresponding period of last year was 70,360 tons.

Lead consumption in the January-March period of this year at 80,711 tons, compared with 81,189 tons in the final quarter of 1945.

NEW PATENTS

The following list of Patent Specifications accepted has been taken from the "Official Journal (Patents)." Printed copies of the full Specifications are obtainable from the Patent Office, 25, Southampton Buildings, London, W.C.2, price 1s. each.

575,106 ANDERSON, R. H., HAMMOND, D. W., HIGGS, A., GUNN, A. D. C., and SHAPLEY, C. S. Furnace hearths.

575,117 HARRIS, K. J., and JACKSON, A. Air and gas compressors.

575,128 METALLIZING ENGINEERING COMPANY, INC. Coating of metals by spraying.

575,129 METALLIZING ENGINEERING COMPANY, INC. Coating metal-surfaced cylindrical objects with sprayed metal.

575,130 METALLIZING ENGINEERING COMPANY, INC. Spray metal-coated, metal-surfaced articles.

575,185 INDUSTRIAL STEELS, LIMITED, and GREENBERG, L. Centrifugal metal-casting machine.

575,195 SUMMERS & SONS, LIMITED, J., and JONES, J. F. R. Open-hearth furnaces.

575,202 MEAD, MCLEAN & COMPANY, LIMITED, and VIDAL, J. F. B. Covering or lining of surfaces or structures with vitreously enamelled plates.

575,251 LINDEMUTH, L. B. Corrugated ingot moulds.

575,293 BEARD, C. L. Apparatus for curving strip metal by upsetting.

575,307 MANDEL, H., and POVEY, L. Process of and means for the manufacture of sheet and like metal parts.

575,336 PRYTHERCH, W. E., and GROSS, P. Production of metallic zinc.

575,343 HARDY METALLURGICAL COMPANY. Powder metallurgy.

575,371 WILD & COMPANY, LIMITED, M. B., and BOUCHER, J. W. Flame-cutting machines.

575,375 WILD & COMPANY, LIMITED, M. B., and BATTY, A. W. H. Flame-cutting machines.

575,478 GENERAL MOTORS CORPORATION. Method of and apparatus for removing moulded objects from cores.

575,569 PARKIN, R. Chaplets for foundry purposes.